THE REFINER AND NATURAL GASOLINE MANUFACTURER

In This Issue

Discussion of various Cracking Methods, including complete details on the Jenkins, Cross and Dubbs processes.

What California is doing in the way of Natural Gasoline manufacture.

Complete list of California Gasoline Plants.

Producing Carbon Black by use of high voltage arc.

Recent refinery patents issued.

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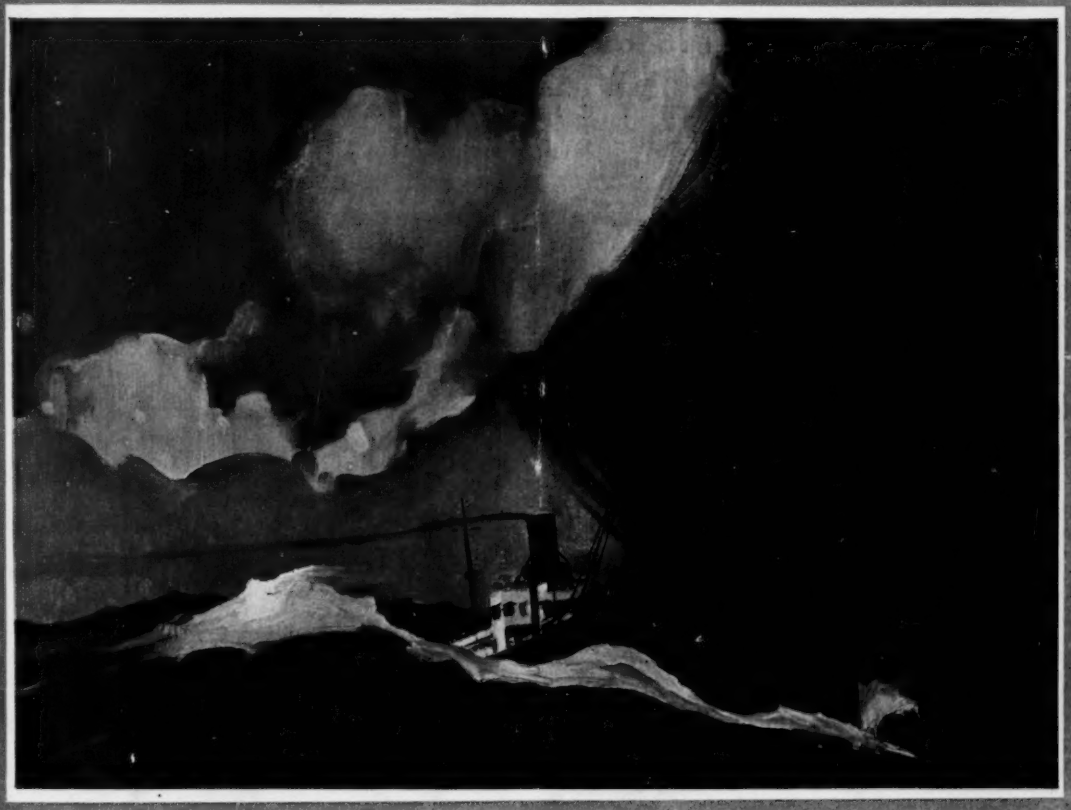

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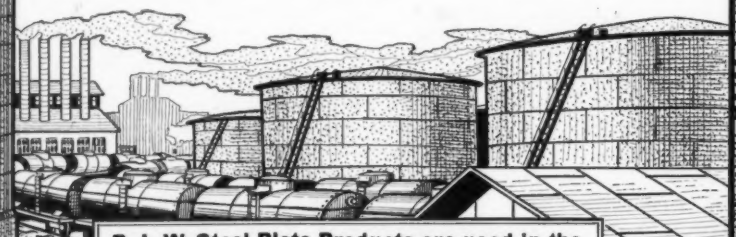

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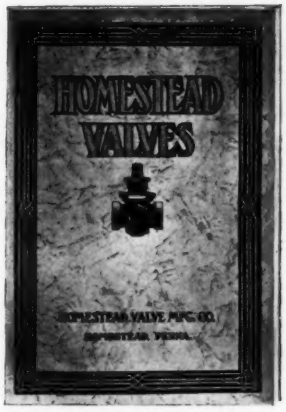

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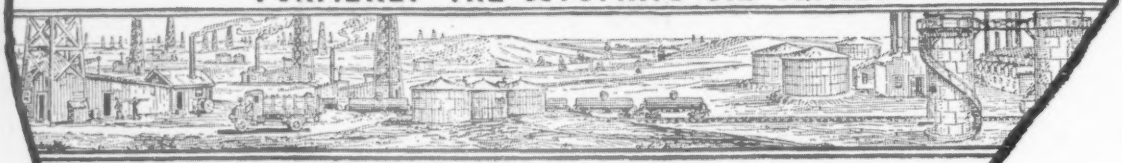

ON OF FOUR OIL TRADE PUBLICATIONS. ONLY

Number 3 CASPER, WYOMING, SATURDAY, JAN. 20, 1923.

MIDWEST REFINING CO. LETS BIG ENGINE CONTRACT TO C. & G. COOPER CO., OF OHIO

THE MIDWEST REFINING CO., at Casper has let a contract for three 1,000-hp Cooper gas engines to the C. & G. Cooper Co. of Mt. Vernon, Ohio. These engines will be installed in No. 4 unit of its gasoline absorption plant in the Salt Creek field. This plant is located on 20 acres not a great distance from the Midwest camp and is recognized as the largest in the world.

Representatives of many of the large engine building concerns of the east were in Casper recently to bid on this large contract and among them were F. H. Thomas, vicepresident and sales manager of the Ohio concern and T. H. Thiel, chief engineer, who were the lucky bidders. The engines are of the type known as directly driving gas compressors and the order for them was placed thru the local concern, Casper Supply Co. which represents the Coopers.

The cost of these engines has not been announced but that a sum of not less than $150,000 would about name the figure is estimated by those familiar with the cost of machinery of this nature.

This contract and the letting of smaller ones for equipment is only a step in the Midwest's plans for

BATES HOLE TEST VERY DIS

Luck?

Midwest Refining Company's No. 1 and No. 2 plants were equipped with eighteen two-cycle belt driven gas engine compressor units.

After visiting a number of large installations and comparing results, their own engineers recommended Cooper standard 970 B. H. P. four-cycle Gas Engines direct driving Cooper Plate Valve Compressors for their No. 3 plant.

These engines and compressors surpassed every guarantee and, after being operated one year, the contract for compressor equipment for the new No. 4 plant was placed with The C. & G. Cooper Company for an exact duplicate of that furnished a year ago. This explains why the Cooper representatives were the lucky bidders.

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R. L. DUDLEY..Manager
F. N. WILLIAMS..Editor

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Cracking Processes

INCREASED use of cracking processes by the major refining companies of the country has tended toward the holding down of gasoline prices which in turn has materially affected the profits of the company operating only a skimming plant.

No doubt there are many ways in which skimming plant operations can be made more efficient, and made to yield a larger percentage of gasoline, but it is an evident truth that even increased efficiency in skimming plant operation still leaves the company with this type of refinery at a disadvantage in competing on the open gasoline market.

It appears that the company operating only a skimming plant has facing it the ultimate alternative of using some commercial cracking process or be slowly squeezed out of business.

Of course there are times of the year when even a skimming plant can be profitably operated, but no plant can hope to make money when it can take a profit during only a few months of the year.

Of cracking processes there are many. The Refiner and Natural Gasoline Manufacturer, recognizing that the American refiner is probably more interested in cracking his distillates than any other problem confronting him, is endeavoring to give, in a series of articles which started in the January issue, some of the outstanding facts regarding each of the principal systems.

These articles are written either by refinery men who have tried them, or by men who are interested in their promotion on a business basis.

We are not attempting to say which is the best process. We simply give you the views of the men who are familiar with them and leave it to the individual reader to form his own judgment.

But we do wish to present to our skimming plant readers this important fact—

It will pay you to investigate the principal processes with the view of installing one in your plant.

The Lube Plant

IT has often occurred to us that the refinery with a good sales department selling only gasoline, kerosene, gas oil and fuel oil, is maintaining a pretty heavy overhead.

The sale of lubricating oil, while the salesman will say is an expert's job, is made to exactly the same people who use gasoline and kerosene, and the experience of companies who do manufacture and sell lubricating oils as well as the light refined products mentioned above, tends to confirm us in our belief that a lube plant in conjunction with an ordinary refining plant will pay.

We hope to present to our readers some articles and figures on the cost of constructing lube units in the near future, and any ideas which our readers may have will be greatly appreciated by us.

The picture of The Tanker used on the front cover of this issue of The Refiner is through the courtesy of the Standard Oil Bulletin

Some Advantages of Dubbs Cracking Process

Can handle up to 20 tons carbon or coke before removal

*By E. R. Lederer and W. F. Fulton**

The object of all cracking processes is the conversion of heavier hydrocarbons into lighter ones, thus making it possible to increase the yield of gasoline produced.

The weak points of the different cracking processes and the main problems to overcome are to maintain the condition desired, in order to convert the heavier hydrocarbons into gasoline without the formation of excess carbon deposits in the apparatus at points which will make it expensive to operate and cause too great "wear and tear" on the equipment and to avoid the production of excess permanent gas, which causes large losses.

There are a few cracking methods which can handle lighter raw material, such as gas oil and heavy kerosene distillate; but the plants intended to handle fuel oil and heavy crudes must be so designed that the carbon formed can be deposited out of the heating zone and easily removed from the apparatus after the run is completed.

The Dubbs cracking process operates on the same principle as most of the other commercial cracking processes, that is, the conversion of the heavier hydrocarbons into gasoline or lower boiling hydrocarbons by the application of heat and pressure to cause decomposition. The Dubbs plant has the advantage of being able to handle up to twenty tons of carbon or coke, which is deposited out of the heating zone in the expansion chamber where it can be easily removed at the end of the run without any material injury to the apparatus, thus permitting continuous operation over a longer period than any of the other methods in commercial use at the present time.

Construction of the Plant

The plant consists of a furnace made of high temperature brick coated on the inside with high temperature cement. This furnace is divided into two sections by a brick wall running through the center. This wall is checkerboarded at the top of the furnace and acts as a shield for the tubes, which are placed on one side of the wall. The furnace is fired from both ends of the combustion chamber, on the other side of the partition and in this manner the flame does not come in direct contact with the tubes, but the heat passes over the top row of tubes, down through the heater coil and out at the bottom through the flue to the stack. The tubes are seamless drawn, No. 4 gauge, four inches in diameter and 30 feet in length. They are supported at three points by Calite beams and insulated heater plates. The furnace usually contains 50 to 52 of these extra heavy tubes, giving a total heating surface of about 1500 square feet; they are connected to form a continuous coil by special drop forged steel headers, which are equipped with plugs, that can be easily removed when the tubes are to be cleaned at the end of each run. The last tube is connected with the expansion chamber by the transfer line. The expansion or reaction chamber is a vertical cylinder (ten feet in diameter and ten or fifteen feet high), made of heavy material to operate at a pressure of 100 to 150 pounds and 850 degrees F. temperature, with a large manhole at the top and the bottom, and housed in a heavily insulated steel shell. The residuum outlet lines lead from the chamber at different levels, in order to allow for the carbon formation in the chamber. The vapor line leads from the expansion chamber to a vertical cylindrical dephlegmator, which is located at a higher elevation than the chamber. The dephlegmator is connected with a leg, which extends below the dephlegmator to within 2 or 3 feet of the ground. This leg is connected with the feed line to the tubes, and in this manner, the reflux is returned to the tubes for further cracking and serves also to preheat the feed. The vapors leaving the dephlegmator pass through a water cooled condenser, where they are condensed under 120 pounds pressure. The pressure distillate and noncondensible gases are received in a receiver drum, which is kept under the system pressure; the liquid is transferred to receiving tanks while the gas is accumulated in a gasholder and used as fuel for operation. This gas is dry and stripped of all gasoline in the process.

The raw material to be cracked is fed to the tubes under pump pressure, which gives a steady flow of the liquid to the tubes, and makes the control of the temperature in the furnace very easy. The portion of pressure distillate, which is returned to the dephlegmator for refluxing the heavier portions of the vapor back to the tubes, is pumped with a small duplex pump.

The pressure gauges, recording thermometers, pumps, meters and control valves, are all placed in the receiving house, from where the entire unit is operated.

The total cost of one 500 barrel capacity unit should not exceed $60,000.000 at the present prices for material; of course this does not include necessary tanks, additional treating and boiler capacity, pipe lines, etc.

Operation of the Plant

When starting up the plant the feed pump is started and the tubes filled; then the furnace is fired and the oil is circulated through the apparatus until the vapors, passing through the vapor line, have driven out all the air in the apparatus so as to prevent explosions.

Then the furnace is brought to temperature and the pressure built up to 120 pounds, or higher, in the expansion chamber. After pressure and temperature have reached the desired degree, (temperature of oil in tubes about 850° F, and the feed from five to ten gallons per minute), the pressure is allowed to pass to the condenser and receiving tank by slowly opening a valve in the vapor line leaving the dephlegmator; finally the three-inch vapor line is opened and the condensate is allowed to collect in the receiving tank until the proper level is reached. From then on the pressure and the level of the condensate are kept the same throughout the operation. The same oil is circulated through the appartus until the gravity of the residuum has reached 20 to 22° Be. and the gravity of the pressure distillate or the condensate has reached 52 to 54° Be. When these conditions are reached, the residuum is allowed to flow through cooler coils to the residuum tank, where the pressure is released. These conditions cover operation on Mid-Continent and North Texas or North Louisiana gas oils and fuel oils.

The pressure distillate is allowed to flow to the rundown tanks; part of it is pumped to the top of the dephlegmator at the rate of two to four gallons per minute in order to reflux the heavy portion of the vapors and return them to the tubes for further cracking, this reflux being fed and recirculated with the raw oil and preheats the fresh feed to about 450° F.

The carbon formed is deposited in the expansion chamber, and as the carbon forms to higher levels the residuum is allowed to flow from one of the higher outlet lines. The height of the residuum in the chamber, being controlled by bleeders in the side, is raised as the carbon forms and the run nears the end; as much as 8 to 9 tons of carbon have been accumulated in one chamber during one run at the 250-barrel demonstration plant at Riverside, Ill.

In shutting down, the oil is circulated until the temperature has dropped to around 300° F, and then steam is introduced into the tubes. Steam is allowed to stay in the chamber about 20 hours, then the top and bottom manholes are removed. Achain is supported in the chamber by hooks in the shell. The object of the chain is to loosen and break the carbon into pieces small enough to pass out of the bottom manhole when it is pulled after the manholes are opened. The carbon is in most cases honeycombed and easily removed from the shell with scrapers.

In the meantime the headers are taken off from the tubes and the upper four rows of tubes cleaned with regular boiler tube cleaners. Coke accumulates in these tubes only in very small quantities, generally only in the upper four rows, which apparently form the most active cracking zone.

The total time necessary between cycles for cooling and cleaning is about 24 hours, after a nine-day continuous run.

We are giving below a few results of some runs which we either personally observed and checked at the Riverside, Ill., 250-barrel plant, or which we

*Research Laboratory, Louisiana Oil Refining Corporation.

were allowed to copy from original and attested reports:

North Louisiana Fuel Oils

Tests of Raw Oil:
Gravity . .... 27.1 Be.
Viscosity . ..220 @ 100° F. Sayboldt Univ.
Cold Test .... 42° F.
Carbon . .... 3.6° (By Conradson Method)
Sulphur 0.66%
Pressure Distillate Produced....1,025,47 Bbls.
Residuum Produced ..... 916.00 Bbls.
Loss, Gas and Coke (Volume).. 58.53 Bbls.
Coke in expansion chamber.... 23,532 Lbs.
Coke in tubes ..... 65.25 Lbs.
Coke in Dephlegmator Leg..... 15.00 Lbs.
Coke in residuum Line ..... 5.5 Lbs.
Coke in Transfer Line ..... 2.5 Lbs.
Total Coke .....23,620.25 Lbs
Or 11.8 Lbs. per bbl. oil run.
Coke per cent by weight of raw oil: 3.78%
Total cycle, 205 hours, or 8 days and 13 hours.
Onstream 177 hours, or 7 days and 9 hours.
Average charge during run: 271.176 bbls. per day.
Average charge during entire cycle: 234.24 bbls.
Total oil charged, 2000.64 bbls.
Pressure .....120 lbs.
Temperature .....850° F.

Yield

Pressure distillate 51.22% of charge 54° Be.
Residuum .....45.80% of charge 22.5° Be.
Loss, Gas and Coke 2.98% (By Volume)

Finished Products

New Navy Gasoline (after treating and rerunning pressure distillate .....31.15% of charge
Gas Oil (Recycling stock) .18.36% of charge
Residuum (Fuel Oil) .....45.8 % of charge

The finished gasoline had a gravity of 58.9 Be. and met strictly all United States navy specifications. It contained 12 per cent unsaturates.

The residuum had a gravity of 22.5° Be., a viscosity of 140 sec. at 100° F. on Saybolt Universal, the sulphur contents was 0.755 per cent and the cold test was reduced to minus 30° F., making an excellent fuel oil for all seasons. Heating value of this fuel oil was 18,750 B. T. U.

The total fuel consumption was 10.26 per cent; the actual fuel oil consumed 5.8 per cent of raw oil, while the difference was made up by using the permanent gases from the process as fuel.

Heavy Mid-Continent Fuel Oil

Tests of charging stock:
Gravity, 23.2° Be.
Viscosity, 347 Sec. at 100° F. Saybolt Univ.
Heat Value, 19,143 B. T. U.
Carbon 4.5% (Conradson Method).

Yields

Pressure Distillate, 29.67% of charge—53.2° Be.
Residuum . .....65.27% of charge—21.2° Be.
Coke gas and loss, 5.06% of charge
Carbon produced, 9,976.5 lbs., or 3.10% (by weight).
Gas produced, 166,100 cubic feet.

Finished Products

Gasoline, 22.4% of charge; 55.6° Be., 437 E. P.
Gas Oil (Recycling stock) 5.64% of charge, 35.7° Be.
Residuum (Fuel Oil) 21.2° Be.
215° Flash
144 Viscosity at 100° F.
Minus 4 Cold Test
19,184 B. T. U. Heat Value.
Total fuel consumption (including permanent gas from process) 10.19% of charge
Daily charge through 250 bbl. unit, 298 bbls.
Duration of run, 96 hours.

Mexican Gas Oil From Panuco Crude

Tests of charging stock:
Gravity. . ..... 26.2° Be.
I. B. P. .....363° F.
E. P. .....710° F.
1.5% over at 410° F.
3% over at 437° F.
Carbon, 1.4%

Final Yields

Navy Gasoline: 29.7% of charge, 52.1° Be.
I. B. P. 120° F.
E. P. 437° F.
Unsaturates 12½%
Gas Oil (Recycling stock)
21.0% of charge 31.3° Be.
Residuum (Fuel Oil) 43.5% of charge 18.4° Be.
Flash, 200° F.
Viscosity, 67 @ 100° F.—Saybolt Univ.
Gas Carbon, loss, 5.8%.
Total fuel consumption, 9.51% of charge.
Uncondensed gas used, 3.95% of charge.
Net fuel oil consumed, 5.56% of charge.
Total Coke produced, 8,127.75 lbs., or 3.17 lbs. per bbl. charged.
Total gas oil charged, 2,569 bbls.
Time on stream, 223 hrs., or 9 days, 7 hrs.

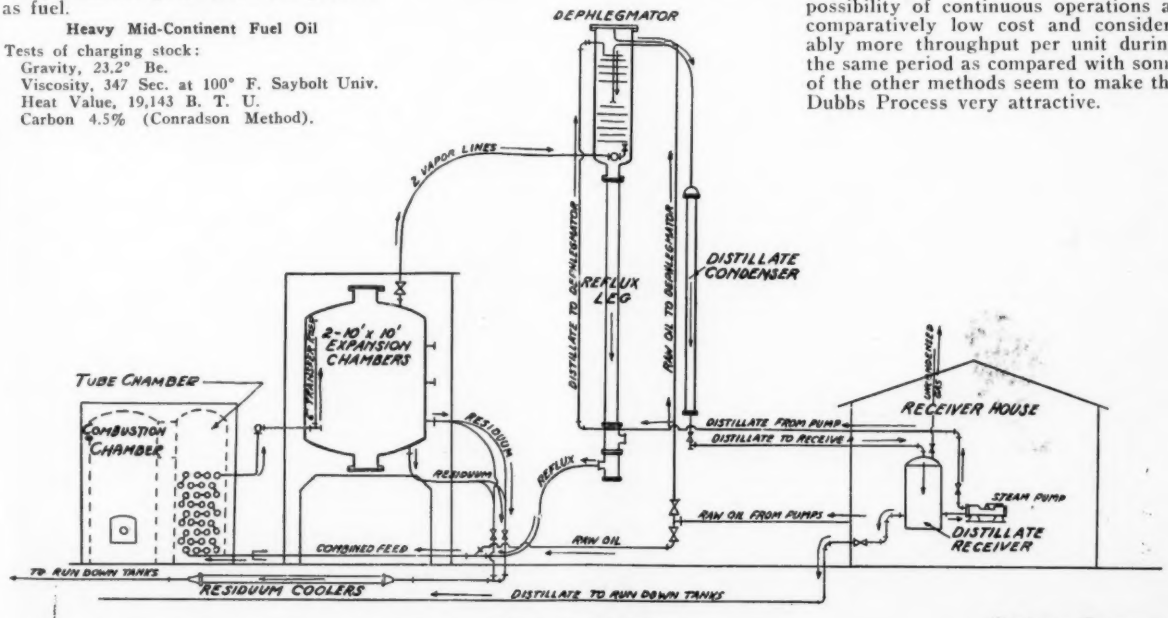
Other interesting commercial runs made on Topped Ranger Crude (26.8° Be.), produced 41.53 per cent of navy gasoline with a total fuel consumption of 12.10 per cent (4 per cent of which was uncondensed process gas); on 18° Be. Sumatra Crude, yielding 32.4 per cent navy end point gasoline and nearly 14 tons of coke on 1200 barrels crude charged.

It can be seen from the above data that this process can operate continuously for nine days without a shutdown. In a commercial unit of 500 barrels daily capacity three nine day cycles per month should be operated without difficulty, cracking 13,500 barrels per unit in 30 days. Cleaning and removing carbon up to 15 tons can be carried out quickly and without great expense. Replacement and maintenance of equipment is low. This method of removing the carbon from the heating zone makes it possible to crack any grade of heavy crude or fuel oil with success. The fact that the amount of oil in the heating zone or in the tubes at one time does not exceed 12 to 15 pounds cuts down the fire hazards.

The process will not operate very satisfactorily on kerosene distillates, the pressure has to be increased to a point which would demand heavier equipment, and fuel consumption is very high. When operating on gas oil alone excellent results are obtained and with recycling actual yields as high as 45 per cent to 50 per cent of the raw oil can be easily produced.

A disadvantage of the process is the fact that the amount of pressure distillate and reflux gas oil, which has to be recycled through the tubes in order to get good yields and a high percentage of gasoline, is very large and causes the fuel consumption to be higher than in other processes not recycling such large quantities. The equipment—and consequently also the initial cost of the installation per barrel charged—has to be comparatively larger as the capacity has to be based on raw oil plus recycling stock.

There is a certain flexibility in the Dubbs Process, enabling the refiner to arrange the quality of the raw oil charged according to market fluctuations, which fact combined with the possibility of continuous operations at comparatively low cost and considerably more throughput per unit during the same period as compared with some of the other methods seem to make the Dubbs Process very attractive.



SIDE ELEVATION

DUBBS PROCESS FLOW CHART

Jenkins Cracking Process Found Profitable

Internal mechanical circulation keeps oil in contact with heating surface

By H. R. Heyne

In the past two years the small refiner who has been just topping and skimming crude has been confronted with a very serious situation. Topping or skimming of crude is no longer profitable and the refiner had to look for means of increasing his revenues. The most natural way for him to do this was to derive from his crude oil the highest percentage possible of products bringing high prices on the market. Since the slump of lubricating oils two years ago the only product still sold at a figure considerably higher than the purchase price of crude oil is gasoline. Therefore the refiner was looking for means and ways of increasing his yields of this fluid. He succeeded in a small way by the installation of towers on the equipment he had. But the increased yields through this proceeding were comparatively small.

It was natural then that the small refiner turned toward processes producing gasoline by means of conversion. There are two distinct types of hydrocarbon conversion processes, one by means of catalytic agents and the other by application of heat and pressure, which are generally known as cracking processes. There are a good many of these cracking processes on the market today but only a very few have been found to be of any commercial value. There are two distinct types of cracking apparatus, one known as vapor phase cracking and the other cracking in liquid phase. Of the latter type there are a few in commercial use, which can be termed successful, but even most of these have not been unqualifiedly successful. In fact most of them, while promising good results, have not been in commercial use at all, or have been used commercially just long enough to give an indication of what they ultimately may do.

The Burton process and the Clark process, of course, have been established as commercial successes by the Standard Oil Company, but of all the newer ones the Jenkins process is the only one which has had commercial installations operating for profit only. Other processes hase testing plants, experimental plants, show-plants, semi-commercial installations, and one or two have completed the installation of commercial units, but none of them run long enough to be classed or termed an unqualified success.

At Sheffield, Missouri, we have in operation three units of Jenkins stills for profit only. We have had these for over a year and have found the process to be very much superior to anything in the art of cracking.

The Jenkins still is a tubular still, the tubes forming the only heating surface. While different in construction it seems to be very similar to the Clark or Dubbs type of cracking equipment; yet, it claims for itself a feature which none of the others possess. This is the internal circulation of the entire liquid mass under treatment within the apparatus by mechanical means. This circulation is patented and unassailable and forms the outstanding feature of the Jenkins process, which tends toward making it the commercial success it is.

In a number of other processes circulation is resorted to as a means toward more complete destruction of the molecule and polymerization and regrouping of the hydrocarbons; but the circulation applied in these processes is one of pumping through units comprising tanks, lines, preheaters, reaction chambers, and back through more lines into reservoirs.

The advantage of internal circulation of the entire liquid mass are readily seen. The oil under treatment is constantly driven through the tubes to which the heat is applied. Here it assimilates the heat required for cracking. At this point I wish to state that there is an idea prevalent in the oil fraternity that cracking is done by pressure as well as by heat. This is not the case. The breaking up of the hydrocarbon is achieved by heat only. The pressure on the stills is solely maintained there to keep the oil under treatment from distilling overhead and to keep it in contact with the heating surface a length of time sufficient to break it up into the desired hydrocarbons.

In a tubular still in which thermosiphon action is the only means of bringing the oil under treatment into contact with the heating surface, and where there is no means other than thermosiphon action to control the length of time the oil is kept in contact with the heating surface, there is a great chance of the hydrocarbon being superexposed to the heating surface. This naturally tends toward a greater destruction of the hydrocarbon than was planned or desired and tends toward the liberation of an excess amount of gas and thereby the production of a large amount of free carbon which is what the refiner is striving to keep away from.

In the Jenkins system, with its artificial circulation, the oil under treatment is being kept in contact with the heating surface only long enough to cause it to break up into the constituents desired. The length of time for the oil to remain in contact with the heating surface is controlled completely by mechanical means. Therefore the amount of noncondensible gasses produced in a Jenkins still is reduced to a minimum, and carbon accumulates in the system only in the proportion in which the oil is converted into the desired product. This control is invaluable for a number of reasons. In the first place the consumption of fuel is extremely low, due to the fact that the oil in circulation constantly wipes the heat of the tubes to which it is applied, resulting in an almost perfect heat transferrence.

In our particular installation the fuel consumption has never exceeded three per cent of the through-put. In fact the fuel consumption figure is guaranteed by the Jenkins people. In the second place the circulation enables the operator to maintain in the liquid mass under treatment the correct temperature at which his oil will crack and give him the desired products in the largest percentage. This is far more than any other process will do.

The carbon produced in the conversion will not adhere to the heating surface but is deposited in places away from the heating surface where it can do no harm.

Due to the factors enumerated Jenk-

Showing a part of a plant at Kansas City where the Jenkins process is used

CRACKING

Our patents do not infringe on others.

No patent litigation.

Our process has been operated commercially for profit for more than one year.

Let us tell you the story with details.

See Page 8

Jenkins Petroleum Process Co.

208 S. La Salle Street Chicago, Ill.

ins still can be kept on pressure stream for a longer period of time than any other still we know of. Only last week we had a Jenkins still on pressure stream for 135 hours. During this period 30 barrels of cracking stock were put through the still per hour, 93 per cent of which was taken overhead. After this run the still was down for cleaning for only 23 hours. It was fired up again the next day after completion of this run and is still running at the time of this writing.

As to the results obtained from cracking with a Jenkins still, I am below giving figures representing a typical run. The cost figures were compiled from all cracking runs made with the Jenkins stills here and represent an average.

Analysis of gas-oil charged into still:

Gravity 31-32 Be., B. P. 525, E. P. 785, cold test 45, coke content 0.64 per cent.

Original charge into still in barrels, 155.

Hours required from lighting fires until releasing, 7.

Hours releasing, 92.

Hours required from fireoff until fireon, including cleaning, etc., 22.

Total cycle in hours, 121.

Barrels of gas oil fed into still in 92 hour releasing period, 2,160.

Barrels of overhead pressure distillate in 92 hour releasing period, 1,806.

Barrels of continuous bottoms drawn off in 92 hour releasing period, 288.

Barrels of oil pumped out of still at the end of the run, 150.

Barrels of fuel oil used in 121 hour cycle, 89.

Loss in operation, 3 to 5 per cent.

Total charge of gas oil into still in barrels, 2,315.

Analysis of continuous bottoms: gravity 25 to 26 Be., flash 260, cold test 0.

No preheater or heat exchanger used.

Pressure carried, 105.

Temperature, 750°.

Per cent of gas-oil charge taken overhead, 78 per cent.

Per cent of overhead finished gasoline, 120 I. P., 437 E. P., 59 gravity, water white, 35 per cent.

Per cent of gas oil charge finished gasoline, not including recycle, 27.5 per cent.

Treating charge, ¼c per gallon on charge.

Cracking operation 15 to 20 cents per barrel of gas oil charged.

Total operating and treating, 25 to 30 cents per barrel on charge.

As to the cost of installing Jenkins equipment, I am below giving a total compiled from our construction records. Prices since that time have gone a little lower, but these figures will give a fair indication of what it will cost to install two Jenkins stills. It must be understood, of course, that at our plant we are using rundown tanks and other equipment, which was already there, in connection with the running of the Jenkins stills.

Two Jenkins stills ready to operate, including stills, condenser box, towers, supports, receiving house, pump room under condenser box, one batch charge duplex steam pump, capacity 250 gallons per minute, one batch pump-out dupler steam pump, capacity 250 gallons per minute, two continuous feed duplex steam pumps, 100 gallons per minute capacity, one air compressor, one gas exhauster, one pump out pan and continuous bottom pan, necessary piping, including expansion pipe bends, cast steel valve fittings, concrete trenches, steel stack, breeching, walkways, operation and engine houses and steam engine drive for propeller, also necessary pyrometers, gauges and meters, $100,000.

As to the product derived from the Jenkins stills I wish to state that at no stage of the process there is produced any appreciable amount of olefins or unsaturated hydrocarbons. The paraffin series oil remains in the paraffin series. None of the olefins or ethylens, which give pressure benzine derived from other processes their pungent odor, and make it so hard to refine, are produced by the Jenkins still. The pressure benzine has a heat test no greater than that of a straight run naphtha distillate and is very easily refined. In fact, we never use more than two pounds per barrel of 66 degrees Baume, commercial sulphuric acid, and finishes into a product of water white color and a very good odor.

The gravity of gasoline manufactured with the Jenkins system ranges around 60 degrees Baume for navy specifications. The gravity of the gasoline drops slightly when derived from recycled stock, but at no time is it as low as gasoline manufactured with other cracking processes. This enables the refiner to sell the gasoline manufactured with the Jenkins system straight and unblended. Chemical analysis has shown it to be a very high grade product, highly desirable as a motor fuel and even used for cleaning purposes and as solvents.

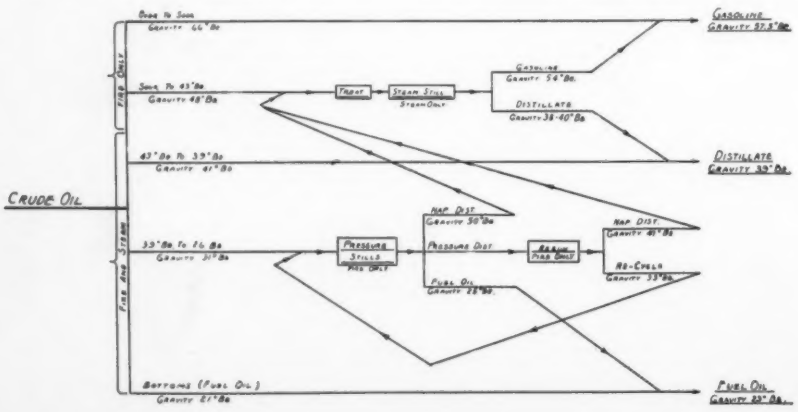
Below I am giving a test sheet showing the tests on a typical car of gasoline derived from the Jenkins stills:

Distillation Record

November 13, 1922.

Sample No. G. A. T. X. 14854.
Tank No. ....
Gravity Baume 60.4.
Initial Boiling Point 110.
Dry Point, 424.
Dr. Test O. K.
First Drop time
Total time
Amt. Distilled 98 per cent.
Loss 1 per cent
Residue 1 per cent.
Reaction
Acid Heat Test 1° F.
Color 25 plus.
Cond'sr Temp. 60° F.

Per cent Off	Temp. Off	Per cent Off	Temp. Off
First drop	110	55	
5		60	285
10	148	65	
15		70	312
20	180	75	
25		80	338
30	208	85	
35		90	366
40	236	95	400
45		97	416
50	262	Dry Maximum	424



Sinclair Makes Report on Output of All Refineries

Washington, D. C.—Information indicating the amount of various refined oils recovered at plants of Sinclair Consolidated Oil Corporation and subsidiaries during 1921 and 1922 was included in the mass of data submitted by company officials to the senate oil investigating committee during their recent hearing in Washington.

The following figures indicate in barrels the amount of refined products turned out at the company's Chicago, Kansas City, Muskogee, Cushing and Houston plants. The figures for the Houston plant of Sinclair do not include gasoline as the refinery runs on heavy crude which is for lubricating oils chiefly:

	1922	1921
Chicago Refinery:		
Gasoline	2,186,960	1,405,520
Kerosene	21,150	141,130
Gas oil	80,680	276,970
Lubricants	3,360	12,250
Fuel oil and coke .	1,071,930	394,870
Kansas City Refinery:		
Gasoline	644,530	587,020
Kerosene	178,540	286,020
Gas oil	106,580	167,370
Lubricants	115	.....
Fuel oil and coke .	1,054,050	853,340
Muskogee Refinery:		
Gasoline	75,110	42,880
Kerosene	24,780	18,150
Gas oil	113,480	80,150
Lubricants	63,440	53,560
Fuel oil and coke	15,970	12,860
Cushing Refinery:		
Gasoline	406,020	516,600
Kerosene	91,600	220,440
Gas oil	41,450	209,290
Fuel oil	700,160	822,540
Houston Refinery:		
Gas oil	644,060	768,600
Lubricants	378,330	496,560
Fuel oil	172,220	265,340

Absorption Process Is Favored in California

About 450,000 gallons natural gas condensate produced each day in that state

There are 110 to 115 natural gasoline plants operating in California, producing in round number, 450,000 gallons of natural gas condensate a day, and two thirds of the plants are using the absorption process.

The reason it is impossible to give the exact number of plants is that some of the larger companies report their total number of power units in each field, without showing into how many separate plants this power equipment is divided.

Official figures on the natural gasoline industry in California for 1921 showed 44 compression and 33 absorption plants in operation. The big change in the number of plants, and also in the ratio between compression and absorption, has come during the past year In fact it estimated that 40 plants have been built during the year or are now being built in the new fields of the southern end of the state.

A study of some of the plants in operation and of the processes being used provides ample proof that the natural gasoline industry is a young industry.

But the fact that no gas is going to waste, at least without first being stripped of the gasoline content, is also a further proof of the economy and efficiency of California oil producers and operators. There has been a scramble among natural gasoline manufacturers for the gas output of every well completed in this state, and no matter what the price of crude oil may be, or what the storage problems may force upon the producers of oil, the market for natural gas is as safe as the market for gold nuggets. In many instances, the oil producer has already sold his gas, if he gets any, or has made provisions for taking care of it and stripping it himself, when he starts drilling his well.

There is as little known about the methods of gasoline extraction used by the various operators, as there is about the various refining processes and alteration of processes, and hybrids, and hocus-pocus methods, in the refining industry. When anybody finds a better way of doing something in the refining industry, he usually builds a wall around the place where he is doing it (either literally or figuratively) and very little information can percolate through the wall. There is some tendency to follow this practice in the natural gasoline business.

This attitude on the part of experienced operators is partly to blame for a lot of wasted effort and profligate practices, in the manufacture of gasoline from natural gas.

In California the absorption method is decidedly in the favor of most operators. Several reasons are given for this. One of them is the relative cost of the mechanical equipment between the two methods. Another, is the greater speed with which absorption equipment can be installed. Another, is the simplicity of the mechanical equipment used in absorption. The nature of the gas itself plays an important part in the consideration. And one factor which has been overlooked heretofore is that the absorber plant connected to high pressure wells is made to serve a double purpose (whether this is an economical gain or loss).

To say that everybody who can get his hands on a few thousand feet of natural gas is in the natural gasoline manufacturing business is literally correct. The public service companies which go out and purchase gas from producers, themselves strip it of its condensable fractions unless it is already stripped before being delivered to them. For example, the Industrial Fuel Supply Company has a big booster station at Placentia, and another at Long Beach, for compressing the natural gas for delivery through lines leading to commercial users. But this company has installed refrigeration plants to operate in connection with its compression units, and so it strips off about 3,000 gallons of natural gas condensate every day, from natural gas which would otherwise be delivered for consumption in its natural state. The same thing is done by several other similar companies; Pacific Light and Power, for example, and Midway Gas Company.

An interesting story is involved in the program which the Standard Oil Company and some of the other companies have worked out for handling this condensate. The Standard is the biggest manufacturer of natural gas condensate in the state, and never retails a gallon of natural gasoline or of blended gasoline. It advertisers it's "Red Crown" gasoline as a straight run product, which it literally is.

Beginning at the well, the Standard handles the gas economically. It has various kinds of gas separators in use. one of the kinds being the so-called Starke Trap, made from discarded casing or line pipe, which is a crude but effective way of separating off the gas from the oil by simply giving them a chance to separate themselves by the force of gravity. The gas is lifted off and delivered to the compressors, for running through the absorbers under pressure.

Then the crude oil is run to semi-vapor proof tanks, where, for a time, a partial vacuum may be applied, to take off all the volatile fractions which rise from the crude in a vaporous state, and these gases are likewise delivered to the absorbers by pressure. In that way, every particle of volatile elements is saved. And while the company has to make use of power equipment for forcing this gas through the absorbers, it nevertheless saves every atom which can be condensed.

Immediately upon condensing the vapors, the condensate is turned into the crude oil tanks, and this crude is then run through straight run refinery stills, and every particle is saved. The Standard thus saves all its natural gasoline, by immersing it in the crude oil prior to refining, although it sells nothing but straight run gasoline. The gravity of its crude oil is materially raised by the application of the natural gas condensate. The Associated Oil Company is doing the same thing on a big scale, buying the natural gas condensate in the fields of Kern County, blending it with the crude oil produced there, and pumping the crude, carrying this natural gasoline in immersion, to its refinery near San Francisco, through pipe line.

It is to be noted, however, that crude oil which has been subjected to vacuum in storage is not readily marketable, and any company which does not refine its own crude oil would probably take a loss from such a practice.

The practice of immersing the natural gas condensate in the crude oil prior to running it through straight run refinery stills raises an interesting question. It is claimed by some engineers that a blended gasoline is not uniform in that it contains high end point fractions in solution with low end point fractions, and that these fractions explode at a vastly different degree of compression in the combustion chamber. That all sounds reasonable enough, on the face of it. But when it is remembered that all petroleum products are soluble, one in the other, and that the change is physical rather than chemical, there is a different angle to the proposition. If the natural gas condensate which goes into the crude oil, is maintained in that crude oil in physical solution with the crude, doesn't that natural gas condensate release itself under heat in the stills, and thus go over containing the same chemical fractions which it contained as a natural gas condensate? If so, isn't it a blend after all? If not, what change actually takes place when the condensate is turned into the crude oil? These questions involve a nice point, and might be studied with profit.

It is interesting to note that several of the recently constructed absorption plants in this state are making use of the natural pressure of the gas from the wells, to circulate the gas through the absorbers. This is making the gas perform a double function. Not only it is providing its own power, through the gasoline plant, but it is maintaining a back pressure on the wells, which, if relieved, would have to be substituted by artificial pressure in order to keep the wells from "getting wild".

However, this is only a temporary expedient. In the course of a few months it will be necessary to remove this back pressure, in order to hold up the production of oil from the wells. At such a time, power units will have to be installed in the newly built absorption plants.

Santa Fe Springs is now producing the richest gas of any field in the state. It is yielding about 2 gallons of condensate to the thousand cubic feet. Long Beach gas, in contradiction to the popular belief, is producing a poor gas, averaging a gallon or less of condensate to the thousand.

In calculating the gallonage output of condensate from natural gas in this state, it has been necessary to develop

an entirely original method of calculation. Taking a number of plants in various fields, on which the capacity was known, both in million cubic feet and in gallonage, an average was struck which represented the average gallonage recoverable from a known footage of natural gas. This average was used in calculating the gallonage capacity where only the footage capacity of natural gas was known.

Where only the number of power units was known for each plant or group of plants, another method had to be worked out. Again making use of the data for several typical plants, where it was known just how much gallonage of condensate is produced by known power units, an average was obtained, showing the number of gallons of condensate which can be produced under average conditions, with each horse power of the power equipment.

A careful check of these methods, against the known output of several plants in the various fields, and the known output of the state at large, proved that while they have local variations in application, the general average for the state is surprisingly accurate.

In giving the plant capacity, or the capacity of groups of plants, however, this journal will make use of the methods generally followed by the owners of the plants. These methods vary between the gallonage capacity, the footage capacity daily, and the power units of each plant or groups of plants. Only the gallonage for the total state is given.

This last figure is not to be taken as representing the amount of natural gasoline which is used for blending into motor fuels in this state. For it has been explained that the Standard Oil Company, Associated Oil Company, Ventura Refining Company, and possibly others, turn their natural gasoline into the crude oil, and refine by straight run processes. The report of the Bureau of Mines on California refining operations for the month of December, said: "In addition to the gasoline output reported there was blended 102,631 gallons of casinghead gasoline." Undoubtedly that statement is correct, so far as it goes. But the 102,631 gallons reported represents only a small fraction of what was actually blended during that period.

In general it may be stated that the average recovery of condensate per thousand cubic feet of gas, by all processes in this state, is one gallon.

In general it is believed that the average recovery of condensate in this state is four gallons a day per horse power of the mechanical power equipment, whether compression or absorption, or combination. This does not account for the condensate produced by natural pressure of wells, by absorption.

In the compilation of the list of plants, this magazine gratefully acknowledges the co-operation of the Ingersoll Rand Company in California; the Bessemer Gas Engine Company in California; and many individual company executives and engineers.

Natural Gasoline Plants in California Feb. 1, 1923

In indicating the capacity of plants, various companies have different ways of reporting. In most instances the capacity is indicated by the number of units and the horse power of each power unit. Others indicate the capacity by the gas footage daily, while others show the gallonage capacity daily, of condensate.

Company and Location of plant	Capacity
Associated Oil Co., Taft	9–165
Bankline Oil Co. (G. P.) Long Beach	¶12
Brown Process Co., Taft	*2500
Calumet Oil Co., Fillmore	1–110
California Gasoline Co., Long Beach	6–160
Canadian Pacific Oil Co., Kern Co.	¶½
Dabney Oil Synd., Long Beach	¶8
Fullerton Oil Co., Brea	2–70
O. C. Field Gas Co., Huntington Beach	¶2
General Petroleum Corporation:	
Santa Fe Springs	¶28½
Santa Fe Springs (building)	¶7
Norwalk plant	¶35
Lewis plant (building)	¶15
Olinda (shut down)	¶3
Brea	4–80
Gilmore Pet. Co., Salt Lake	2–80
Gilmore Pet. Co., Long Beach	2–165
Honolulu Consolidated:	
Taft	18–165
Taft	12–150
Taft	12–80
Taft	1–40
Taft	20–30
Hurley Smith Co., Salt Lake	2–150
†Industrial Fuel Co. Placentia	16–165
†Industrial Fuel Co., Long Beach	12–165
Lovell Gasoline Co., Taft	3–80
Long Beach Gas. & Ref. Co., Long Beach (building)	¶10
LaHabra Gasoline Co.:	
Taft	3–150
La Habra	2–25
La Habra	10–150
Maricopa	2–150
Mutual Ref. Co., Huntington Beach	¶1
Montebello Oil Co., Fillmore	4–110
North Am. Cons., Kern Co.	¶½
Natural Gasoline Co., Santa Fe Springs	¶¾
Olinda Gasoline Co., Olinda; 2 plants	4–150
Pan American Pet. Co., Kern Co.	¶4
Pacific Gasoline Co.:	
Taft, 8 plants, total	57–150
Fellows	2–50
Huntington Beach	4–150
Huntington Beach	2–150
Brea; 2 plants, total	*8000
Santa Fe Springs	*6000
Ventura	*3000
Petroleum Midway, Ltd.:	
Huntington Beach	6–165
Long Beach and Santa Fe Springs	24–165
Long Beach	7–15
Montebello (building)	¶1
Pacific Gas Corp., Huntington Beach (building)	¶2
Pacific Light and Power, Salt Lake	2–165
Rice Ranch Oil Co., Orcutt	1–200
Rice Ranch Oil Co., Orcutt	1–50
Rancho La Brea Oil Co., Salt Lake	3–165
Richfield Oil Co., Taft	3–165
Standard Oil Company:	
Kern County, (Tupman plant)	¶5
Kern County, Pan Am. plant	¶12
Kern County, Darby plant	¶2½
Kern County, Eagle Creek	¶1½
Kern County, Lost Hills	¶1
Kern County, Sec. 14	¶1
Kern County, Sec. 28	¶1¼
Kern County, Hay	‡3500
Montebello, (Temple plant)	4–160
Montebello	15–160
Santa Fe Springs	4–160
Santa Fe Springs	8–160
Whittier Coyote	‡4500
Whittier Coyote	‡4500
Newhall	2–80
Huntington Beach	16–165
Placentia	16–160
Kern County No. 1, McNee	5–475
Kern County No. 2, McNee	1–250
King Gasoline Co., Taft	4–150
Sterling Gaso Co., Long Beach (bldg.)	
Southwest Gasoline Co., Long Beach	¶15
Signal Gasoline Co., Long Beach	¶15
Signal Hill Gasoline Co., Long Beach	¶1
Signal Hill Gasoline Co., Long Beach	¶2
St. Helens Pet. Co., Montebello (bldg.)	
St. Helens Pet. Co., Brea	*200
Shell Co. of Calif.:	
Long Beach	9–160
Long Beach (absorption)	¶14
Brea	3–160
Santa Maria, 2 units. Each 400 h. p. electric motors. 3rd unit building.	
Olinda	2–80
Titan Gasoline Co., Long Beach	2–165
Tremayne Refrs., Santa Fe Springs	¶1½
Tremayne Refrs., Santa Fe Springs (bldg.)	¶1½
Union Oil Company:	
Huntington Beach, 4 units, abs.	
Long Beach, (2 units)	¶8
Brea, 2 units.	
Brea, 1 unit.	
Ventura County, 1 unit.	
Orcutt	9–80
Ventura Ref. Co., Fillmore (Santa Paula)	10–165
Ventura Ref. Co., Fillmore	1–80
Wilshire Oil Co., Taft	4–150
Wilshire Oil Co., Huntington Beach	*4000
Wonder Oil Co., Richfield (shut down.)	

*Gallons.
¶Million ft. gas.
†Booster and compression.
‡Horse power.

New Schedule Proposed For Gasoline Expansion

Dallas, Texas. — Adoption of the United States Bureau of Standard's schedule on determining the coefficient of expansion of gasolines and kerosene is being proposed by the Union Petroleum Company to the independent refiners in the Southwest that furnish the bulk of the products purchased by Union for export delivery, according to W. A. Tracey of the export department of Union with headquarters at Philadelphia. The present schedule in effect is forcing Union to sustain a huge loss over the year, because of the volume of business conducted, according to Mr. Tracey, who is visiting each refiner in person to ascertain their attitude on the contemplated change, and the adoption of the Bureau of Standard's method of determining the coefficient of expansion will not incur a great loss to the refiners individually. The Standard companies and other export buyers are already using the Bureau's schedule.

New Experiment Station For Bureau in Oklahoma

Bartlesville, Okla.—Funds for another building for the experiment station of the United States Bureau of Mines here are to be asked from the Oklahoma legislature now is session. T. E. Swigart, superintendent of the station, says $45,000 is needed for a new building, which would enable the station to have more offices, as well as increased laboratory and shop space.

The station here is maintained by the state of Oklahoma and the United States government. No increase is being asked for maintenance of the station, which is $37,500 from each government for each year.

Producing Carbon-Black by High Voltage Arc

Demand for gas necessitates turning to other methods for manufacturing product

*By J. J. Jakowski**

Washington, D. C.—The legislation in many states against the present method of producing carbon-black by the incomplete combustion of natural gas, and the continually increasing demand for gas for other purposes, indicates that the supply of carbon-black may gradually be decreased and that new methods for its production, utilizing a greater percentage of the carbon in the gas should be developed. In the course of investigations of the effects on hydrocarbons of high voltage discharges, it was noted that under certain conditions natural gas could be decomposed and that carbon-black could be produced.

The effects of several types of electrical discharges on natural gas have, accordingly, been studied in order to find out the fundamental factors underlying the reactions and their possible influence in the recovery of a greater part of the carbon content of natural gas than is now possible. Present commercial plants using natural gas for the manufacture of carbon-black recover from 0.8 to 1.5 pounds of carbon-black per thousand cubic feet of gas consumed, or less than five per cent of the total carbon in the gas. It should be noted, however, that the present methods involve heating the gas to incondescense by burning it as a luminous flame, and a considerable part of the gas is thus consumed as a source of heat. If this heat can be supplied from some other source, or if a more efficient method of applying the energy contained in part of the gas, to the decomposition of the rest of it, can be worked out, then a greater yield of carbon-black per thousand cubic feet of gas can be expected. The present short paper contains a brief summary of the investigations so far conducted upon natural gas.

Apparatus Set-up

The gas used in the experiments was Pittsburgh natural gas and was passed through the train of apparatus shown diagrammatically in figure 1. The gas was measured by passing it through a wet meter, then given a preliminary drying by bubbling through concentrated sulphuric acid; passed through a tube containing glass wool for the removal of acid spray, thence through a long phosphoric anhydride tube for final drying. The rate of flow was regulated by a simple regulating cock and the flow meter.

The electrical apparatus and diagram of connections are shown diagrammatically in figure 2. The equipment consisted essentially of a 15-KVA distributed-shell type step-down transformer; voltage switch, 110, 220 or 440 volts, adjustable impedance coil; primary switch controlling eight taps on step-up transformer primary; 10-KVA step-up transformer, rectangular core type; measuring and indicating meters—voltmeter, ammeter, and wattmeter. The secondary of the step-up transformer was constructed in four pieces allowing the coils to be connected in series, series-multiple or multiple. This arrangement, in connection with the voltage regulation on the primary circuit, allows any voltage from 2000 to as high as 150,000 volts to be used for experimental work.

*Assistant refinery engineer, Pittsburgh Experiment Station, U. S. Bureau of Mines.

Nitrogen-Fixation Apparatus

In the beginning of the investigations, it seemed advisable to experiment with apparatus patterned somewhat after the different types of electrical nitrogen-fixation apparatus. Numerous attempts to obtain smooth operation and high yield proved unsuccessful, but of such experiments, many were valuable as indicating the essential factors in proper control of conditions and apparatus design. A brief description of these experiments follows:

An apparatus similar to that used in the Pauling nitrogen-fixation process was constructed. The electrodes are horn-shaped, similar to the horn gaps on high voltage transmission lines for protection against high voltage surges and lightning. When operating in air or other easily ironized gas, the arc starts at the bottom, where the gap is shortest, and is deformed and carried upward by the heat and the rapid stream of incoming air. A fresh arc strikes at every reversal of the alternating current and the rapid succession of arcs gives a sheet of flame. This type of apparatus gave a broad extended surface of flame when operating in air, but failed to operate satisfactorily when natural gas was passed through the apparatus; evidently the quenching action of the hydrogen-methane mixture prevented the arc from spreading out and traveling upward. Difficulty was had in preventing carbon "trees" from building out near the bottom of the horns, where the arc stayed, and shortening the gap. A number of attempts were made to utilize this form of gap, using different gap lengths, and voltages from 2000 to 70,000, 60 cycle, but without success.

Magnetically Spread Arc

Considerable time was spent in experimenting with an apparatus similar to the Birkeland-Eyde magnetically spread arc for nitrogen fixation. Little difficulty was met in extending the arc in an atmosphere of air and a large flat flame disk was obtained. In natural gas, however, it was impossible to effect very much spreading of the arc, although the data obtained seemed to indicate that the spread arc is beneficial and that the actual energy required per pound of carbon-black formed is less than when the arc is not extended, the power required for the formation of carbon apparently decreasing with the extent of spreading of the arc, or the flame surface exposed. In practically all cases, the wattage required to produce the magnetic field is nearly as great, or greater, than the energy used in the arc, which gives a much lower net efficiency for the spread arc method. However, the method seems to offer possibilities, and as increased amperage in the high voltage arc may allow a decrease in the exciting current for the magnets, which beyond a certain point may result in a higher over-all efficiency. In a large apparatus where a considerably heavier current is flowing, such a method would probably give a much higher efficiency, as a comparatively weaker magnetic field could be utilized with a heavier current flow in the arc itself.

Schonherr-Hessberger Process

A type of arc and apparatus that would probably be very advantageous, assuming that the more the gas is thrown into the arc the greater the decomposition, is that the Hessberger type in which an arc is started between one end (usually the bottom) of the treater tube and a short central electrode. In this set of experiments the discharge chamber consisted of a vertical pipe grounded and serving as one electrode. The pipe was two inches in diameter; at the bottom was fastened the gas inlet and insulating lead-in for the central electrode. The arc was started by bringing the central electrode in contact with the vertical pipe. The air entered tangentially and in such a way as to "blow" the arc upward in the tube. Little difficulty was encountered in drawing out a long arc when using air, but when natural gas was passed through the apparatus, the arc was either completely "blown out" or else took place (providing a high enough voltage was being used) between the central electrode and the nearest point on the vertical tube. Voltages varying from 1000 to 70,000, 60 cycle, were used.

Revolving disk

A one and three-eighths inch brass disk was perpendicularly mounted upon a small motor driven shaft placed centrally within a two inch pyrex tube. The disk formed one electrode and a one-eighth inch hollow copper rod through which the gas entered near the edge of the disk, formed the other electrode. The disk was revolved at a speed sufficient (in air) to "wrap" the arc around the periphery of the disk. The speed at which the disk revolves in order to spread the arc depends largely upon the diameter of the disk and the voltage being used. The gas was discharged into the arc a little above the revolving disk. In order for the gas to reach the outlet of the pyrex tube, it had to pass through the "spread" arc. After trying the apparatus with air, natural gas was used but the arc did not spread out. Instead it discharged directly across from the hollow rod to the near edge of the revolving disk. Different discharge voltages and speeds for the disk were tried but without success.

It seemed evident from these experiments that it would not be practical to use any of the preceding types of appa-

ratus, nor indeed any that depended for its efficiency on "spreading" the arc.

Intermittent Type Apparatus

This form of apparatus was one of the first types of apparatus tried after experimenting on the nitrogen-fixation type. The general construction is indicated in figure 3. The electrodes were insulated by heavy wall pyrex tubing, and the gas was passed into the apparatus through the annular space between the upper electrode and the interior of the pyrex tube. The pyrex tube extended about one-eighth inch beyond the end of the upper nichrome electrode, in order to have as much of the gas as possible pass into the arc Attempts were made to have the tube extend further beyond the electrode, in order to form more of a sleeve or shield around the arc, but difficulty was experienced, through carbon deposition, since the carbon was deposited on the tube and the arc shifted over to the edge of the carbon covered or "shorted" tube.

The carbon formed during the decomposition of the gas settled on the walls of the bell jar and on the pyrex lead-in tubing. The apparatus could not be operated for periods greater than 30 to 45 minutes because of "shorting" of the electrodes by the deposited carbon. The treated gas from the apparatus was passing through a cotton filter and thence into the atmosphere. Considerable carbon was caught in the filter and the weight of the carbon collected here was added to that precipitated in the bell jar. Appreciable quantities of naphthalene were formed during the runs and small crystals were formed in the cotton filter.

The carbon in the apparatus collected in rather an interesting form, resembling stringy cobwebs—which, however, were easily broken up with a brush into a very finely divided carbon-black. If the carbon is allowed to remain in the arc for any appreciable length of time, it gradually changes from a finely divided to a hard gritty form, which, if allowed to remain in the arc, soon turns to a dark gray color with a somewhat crystalline form. In order to keep the carbon out of the arc and also to keep the electrodes clear, various mechanical devices were used. The simplest, however, which was also fairly satisfactory, consisted of heavy vibrators (large type electric bells with gong removed) tapping the electrodes. A vibrator was used on each electrode, as shown in figure 3, and very little difficulty was experienced due to carbon "trees" building out and "shorting" the electrodes.

Operating Characteristics

The amount of carbon-black recovered per unit volume of gas treated varies with the current, rate of gas flow and type of apparatus. The cruves in figure 4 and data in table 1 show the operating characteristics for the intermittent type of apparatus.

The carbon recovered varied with the rate of flow; the slower the rate of flow, or the longer the gas is exposed to the arc, the greater the percentage of carbon recovered. This relationship is shown in curve 3.

The carbon recovered also varies with the current; the temperature of the arc being a function of the current. (See curve 1.) As the current is increased, evidently as a result of variation in the temperature of the arc, the carbon yield per unit volume of gas is increased; this relationship holding within certain values. In practically all types of apparatus, no carbon is formed when the current is decreased below a certain minimum value. This is probably due to the low temperature of the arc. As the current is increased, the temperature of the arc rises and at a certain current flow depending upon the type of apparatus and arc, the decomposition of the methane begins. Increasing the current flow produces an increased yield of carbon, but a point is soon reached beyond which an increase in current is accompanied by only a slight increase in the yield of black. This seems to be due to a combined effect produced by arc temperature and content between gas and arc. The rate of decomposition of the gas undoubtedly varies with the temperature—the higher the temperature the greater the dissociation of the gas and the lower the percentage of undecomposed gas in equilibrium with its elements—although this reaction is influenced to a large extent by possible side reactions such as the formation of naphthalene and products of condensation or polymerization offsetting the theoretically increased advantage gained by higher temperatures are two factors; first, an apparently poorer quality of black produced at the higher temperatures and, second, the decreased contact between gas and arc at the higher temperatures. At the higher arc temperature the gaseous particles have a greater velocity and by bombardment would actually tend to prevent the easy entrance of cooler gaseous molecules. The surface area of the arc also increases only slightly beyond a certain amperage flow.

Since the amount of carbon recovered varies with the current, different types of apparatus have a somewhat different k.w.h—ampere curve. For the intermittent type of apparatus the optimum operating condition, that is, the point at which the yield of carbon per k.w.h. input reaches a maximum, was at about six amperes flowing in the primary circuit, and a k. w. h. input of about 41 k.w.h./lb of carbon recovered. See curve 2.

Continuous Type Apparatus

The greatest difficulty encountered in the operation of a high voltage electrical arc process for making carbon-black from natural gas is due to "shorting" of the electrodes and lead-in tubes by the fluffy deposited carbon. The carbon is extremely light and floats, depositing on all sides of the interior of the apparatus. In an effort to overcome the "shorting" of the electrodes, a number of different types of mechanically operated pieces of equipment were designed, but the results were not satisfactory. The following design of apparatus, utilizing a water or oil wash, operated satisfactorily, and little difficulty was met in keeping the apparatus in continual operation.

The apparatus consisted of an upper electrode and gas inlet, provided with a spreader or umbrella; a pyrex glass tube or reaction chamber; a lower electrode; suitable drain for the wash solution; overflow cups; and a settling tank. Two buzzers were used to keep the electrodes free from carbon "trees."

The natural gas entered the apparatus through a side inlet tube in the upper electrode and flowed between the annular space between the nichrome electrode and the inside of the lead-in tube. After being exposed to the arc, the residual gas passed out of the apparatus through the drain, where it was thoroughly scrubbed to remove floating carbon particles. The drain pipe should be of sufficient length and the smallest diameter practicable, in order to obtain thorough scrubbing of the exit gases. The finely divided form of carbon black makes it removable from the exit gases with difficulty. If the drain pipe is too large in diameter the wash solution flows in the lower part of the pipe, while the exit gases "channel" in the upper part of the pipe and considerable carbon is carried out by the gases. By correctly proportioning the drain pipe to the amount of wash oil or water, thorough scrubbing of the exit gases can be effected.

The oil or water wash solution entered the upper part of the reaction chamber above the spreader or umbrella. The spreader consisted of a circular plate about one-eighth of an inch smaller in diameter than the inside of the chamber. Due to capillary attraction the wash solution flows down the inner side of the chamber, forming a liquid coating or wall upon which the carbon formed in the arc is thrown. The carbon is thereby washed out as fast as formed, and the difficulties due to carbon deposition are avoided.

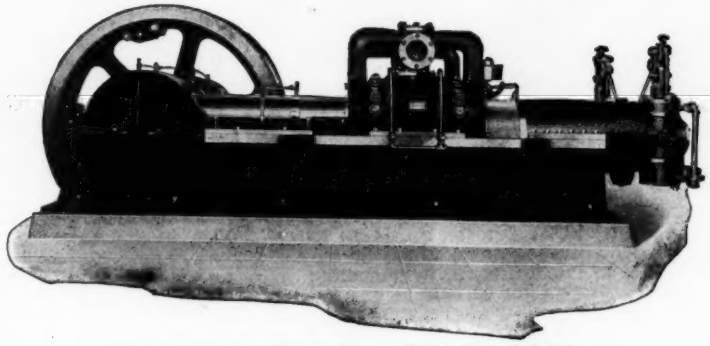
In the intermittent type of apparatus the lead-in tube on the upper electrode projected beyond the end of the electrode in order to cause as much of the gas as possible to pass through the arc. In the continuous type of apparatus, the lead-in tube is shorter than the electrode and the incoming gas completely fills the upper part of the reaction chamber. When oil, or comparatively pure water having a low conductivity, is used as a wash, the reaction chamber may be made small enough in diameter to have the arc almost completely fill the space inside the downward flowing washwall. In this way the gas is forced to pass through the arc.

The wash solution, with its collected carbon, drained to the settling tank, first passing through a series of overflow cups to prevent agitation of the solution in the settling tank.

If water is used as a wash solution, the carbon, probably because of its coating of gum formed from the polymerized reaction products of the arc, floats to the surface of the water and collects as a heavy scum. This scum may be scraped from the surface of the water and placed in a drying oven at about 105 degrees C. and dried. After drying, the scum is very easily broken up with a brush, producing a finely divided form of carbon-black.

When using oil as a wash solution, the carbon gradually settles out and collects in the bottom of the tank. The oil and carbon may be separated by a number of different methods, but the following procedure was employed in the laboratory. After allowing the solution in the settling tank to stand for 24 hours, the wash oil was drawn from the tank, leaving a mixture of carbon and wash oil. This sludge was next suc-

THE NEW ENCLOSED TYPE



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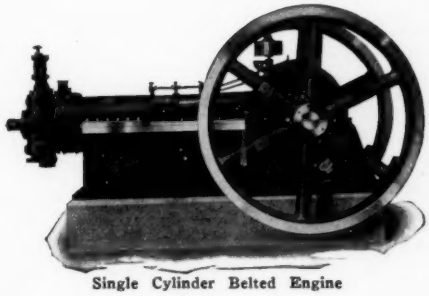

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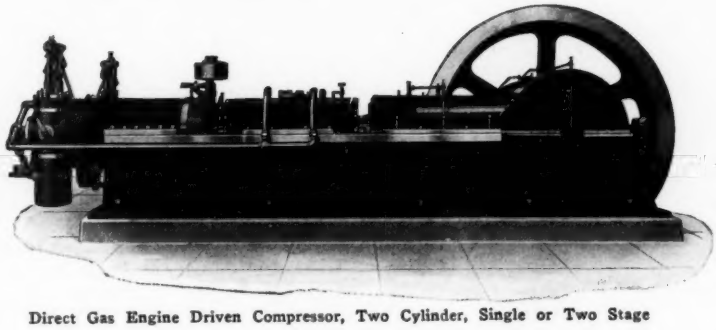

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cessively washed with light gasoline (having an end point of 160 degrees C.) to remove the heavy wash oil and gums in the carbon. The sludge was then filtered, the carbon not passing through the filter paper. After drying at ordinary room temperatures, the carbon "lumps" were removed and easily broken or disintegrated into their finely divided forms. Attempts were made to dry the original sludge coming from the settling tank without first washing with solvent gasoline to remove the wash oil and gums. The heavy oil and residual gums remaining in the carbon even after filtration, required a comparatively high temperature (300 to 400 degrees C) to remove them completely, and the resultant carbon was hard and contained many gritty particles. The heavy oil and gum apparently acts as a "binder" for the carbon particles and produces a hard "coke" instead of the finely divided form of carbon desired. It seems probable, however, that the original carbon-kerosene sludge could be used in a number of industries. Present practice, especially in paint and pigment trades, requires the mixing of the black with oil. It seems probable that the carbon-kerosene sludge could be centrifuged and enough oil removed to leave a heavy paste which, in many ways, would be advantageous and easier to mix than the dry carbon black used at present.

The operating characteristics for the continuous apparatus are practically the same as for the intermittent apparatus previously mentioned. When using water as the wash solution, however, the results are slightly lower per K. W. H. input, and also difficulty was had in obtaining a smooth operating curve. The presence of the water vapor lowers the yield of carbon black produced per K. W. H. input of energy. The exit gases leaving the apparatus also contain larger quantities of CO nd CO_2 indicating a reaction between the hydrocarbons and the dissociated water vapor. Presence of water vapor lowers the efficiency of the apparatus from 5 to 10 per cent.

When using oil as a wash solution, the efficiency of the apparatus is practically identical with that of the intermittent-type apparatus.

Miscellaneous Equipments

A few experiments were tried wherein the gas and the arc were passed through holes in mica or transite disks. One form of apparatus used consisted of a 2-inch pyrex tube fitted with two mica disks spaced about one inch apart. The electrodes were placed on a line with the centers of the holes in the disks, and each about one-half inch outside the disks. The discharge passed from an electrode through the holes in the two disks, to the other electrode. The gas was admitted at one end of the pyrex tube and passed through the first disk, then through the second disk, and out of the tube. This type of apparatus was used to make the gas come into the arc. Enough amperage was used to make the spark "fat" and completely fill the holes in the disks. Almost complete decomposition of the natural gas was obtained, and most of the carbon was formed when the gas passed through the hole in the first disk. Because of the high voltage necessary, the number of k. w. h. per pound of carbon recovered was not so low as was obtained in experiments using the type of apparatus described at the beginning of this preliminary paper. This design of apparatus also gave considerable trouble from deposited carbon "shorting" the electrodes.

Effects of Pressure

The effects of pressure on the energy required to decompose the gas has not been determined for any one type of apparatus. The data available are fragmentary, but seem to indicate that the energy varies somewhat inversely with the pressure. In one series of runs, with a pressure of 183-184 m. m. of mercury, the energy consumption varied from 48.4 k. w. h. to 132.2 k. w. h. per pound of black. At atmospheric pressure, the minimum current consumption per pound of black, which in any one type of apparatus varies with the rate of flow, varied from 40.5 k. w. h. to 41.8 k. w. h.

A diminished pressure, according to Le Chateliers' theorem, would be expected to prove benficial in promoting the decomposition of natural gas because of the increase in volume accompanying dissociation, such as the decomposition of methane ($CH_4 = 2H_2 + C$), where one volume of methane produces two volumes of hydrogen.

The apparently greatly increased efficiency secured from runs at atmospheric pressure seems to indicate, however, that the concentration may have an effect—largely due to the law of mass action—greater than that produced by volume changes. The increased losses per pound of gas treated at the lower pressure may be due to radiation, since the radiation from the arc will be continuous while the number of pounds of gas treated in a given time will be less at the lower pressures.

No experiments have been conducted to determine in detail the effects of pressure in any one type of apparatus. The conclusions drawn here are based upon rather quantitative results from different types of apparatus and it should be realized that the values given above may vary considerably, due to the apparatus itself as much as to the effects of different pressures.

In order to get a more intimate "mixture" of the electrical discharge and the gas, the pressure was reduced until the gas itself could be easily ironized and become the conducting medium. Different pressures and voltages were used but the results indicated that much of the energy was lost by radiation, etc., and the carbon yield per k. w. h. was considerably less than when working at atmospheric pressure.

A few experiments were made in an effort to determine if the yield of present carbon black plants, where the carbon is made by the incomplete combustion of gas, could be increased by using an arrangement similar to the Cottrell precipitator and precipitating or "throwing out" the particles of incandescent carbon before combustion took place; assuming that luminosity of a flame deficient in oxygen is due to particles of incandescent carbon.

A luminous flame burner was surrounded by a 1½-inch tube, which served as the outer electrode, and was provided with an insulated central wire for the other electrode. Carbon was deposited on the walls of the tube, but considerable difficulty was met in keeping the current from "blowing out" the flame. The flame could, in every case be extinguished by the application of a high enough voltage to the central wire and tube. Sixty-cycle alternating current and rectified Kenetion current at voltages ranging from 1000 to 10,000 was used but accurate quantitative runs could not be made because of the unsteadiness of the flame when the high voltage was applied to the apparatus. What data were obtained, however, apparently indicated that the carbon yield per 1000 cubic feet of gas was not appreciably increased over that recovered by the present plants.

It seems probably that the carbon liberated, when natural gas burns in an atmosphere deficient in oxygen, results from decomposition of the gas by the heat of the flame rather than from any preferential combustion of hydrogen and certain hydrocarbons. It also seems probable that the only function of the cold surface is to quickly cool the carbon and thereby prevent its combustion.

Effects of High-Frequency Current

A high-frequency discharge or arc does not decompose natural gas to form free carbon. The experiments with high frequency were run on the intermittent-type apparatus but in no test did the high-frequency discharge produce carbon black. Radio frequencies were used, the condenser being placed directly across the discharge electrodes without any inductance in the circuit. The high-frequency discharge was very hot, and so far as measurements by optical pyrometer are concerned, was hotter than the low frequency arc. The temperature of the high-frequency arc varied, depending upon the current flowing and capacity, from about 2000 degrees F. to 3000 dgrees F., while the temperature of the 60-cycle arc was from about 1500 degrees F. to 2000 degrees F.

The high-frequency experiments seem to indicate that the decomposition of natural gas by a high voltage arc is not purely a heat reaction. A complete study is contemplated in the near future as to the effects of the high-frequency discharge and it is hoped that this study will give some indication as to the mechanism of the reaction for the formation of carbon black from natural gas. Studies are also contemplated on the effects of different currents and waves; effects of damped and continuous waves, as well as the regular high voltage direct current arc.

A few experiments were tried using a low voltage (110 and 220 volt) arc but the quality of the recovered carbon was considerably inferior to that recovered from the high voltage arc. The carbon in color and in many other physical properties, seemed to resemble carbon produced by the thermal decomposition of natural gas; that is, where the gas is decomposed by being passed through hot tubes, brick checkerwork, etc. The carbon from the low voltage arc also contained many hard particles which were crystallized and more like the color of graphite. The low-voltage, high-amperage arc apparently has a temperature considerably higher than that at which good quality carbon black can be formed. The electrodes themselves volatilize and the recovered carbon product is mixed with a considerable quantity of the volatilized material.

Power-Factor Considerations

The power-factor of a high-voltage arc equipment will be comparatively

Loading and Unloading Inflammable Liquids

Proposed rules apply mostly to installations prior to Jan. 5, 1920

New York, N. Y.—On November 22, 1922, representatives of the industry appeared before the Committee on Safe Transportation of Explosives and Other Dangerous Articles of the American Railway Association, at Chicago, in opposition to a proposed revision of A. R. A. Circular 2084 which would make certain provisions of that circular retroactive and applicable to locations in existence prior to January 5, 1920, the date when the original circular B. C. L. 190 was issued.

The industry's objection to Colonel Dunn's proposal to make the circular in part retroactive was sustained by the committee, but the industry's representatives were obliged to agree that a special committee would confer with the committee and work out a set of reasonable operating rules which would provide additional safety which the railroads felt desirable for old locations. The Institute subsequently appointed a special committee on operating rules.

The institute committee met in New York on January 16 and drafted a set of rules which in its judgment would serve the purpose desired by the railroads and on January 17 Messrs. W. R. Boyd, Jr., R. W. Ostrander (represented py George H. Tower), J. A. Watterson, B. J. Burchett, H. W. Roe, C. E. Woodbridge (represented by F. B. Gatchell), Henry Hauseman (accompanied by E. O. Overman, construction engineer of the Pure Oil Company), R. E. Gerkins and W. M. Welch, the president of the Association of Natural Gasoline Manufacturers, representing the committee held a joint conference with the American Railway Association committee and Bureau of Explosives representatives and after a harmonious discussion agreed that the attached material should be issued as a new American Railway Association circular to apply only to facilities established prior to January 5, 1920.

It was also agreed that the corresponding operating paragraphs of circular 2084 could properly be amended to conform with the language of the operating rules in the proposed new circular for old locations.

The committee recommends that its action and work be approved by the institute and the industry.

Proposed A. R. A. Circular

Rules to be observed in the operation of loading, unloading and storage facilities established prior to January 5, 1920, for the handling of cansinghead gasoline, naphtha or any other inflammable liquid with a flash point below 30° Fahr.

The operation of loading, unloading and storage facilities for inflammable liquids is of importance and uniformity in the observance of proper safeguards for the protection of life and property is desirable.

The following rules apply only to facilities established prior to January 5, 1920. The rules governing location and operation of facilities established since January 5, 1920, are contained in the circular.

Loading

1. In loading casinghead gasoline, the tank car and the storage tank shall be so connected as effectually to permit the free flow of the gasoline vapors from the tank car to the storage tank and to positively prevent the escape of those vapors to the air, or the vapors must be carried by a vent line to a point not less than 100 feet distant from the nearest track over which passenger trains are moved.

Unloading

1. Where old installations for unloading casinghead gasoline are located within 75 feet of a track over which passenger trains are moved a retaining wall, dike or earthen embankment shall be placed between the installation and the track, so constructed as effectually to prevent liquids from flowing on to the track in case of accident.

Storage

The following storage regulations apply only to above ground tanks for which railroad service is required. All storage tanks will be considered above ground unless they are buried so that the top of the tank is covered with at least three feet of earth.

1. All tanks should be set upon a firm foundation.

2. Each tank over 1000 gallons in capacity shall have all manholes, handholes, vent openings, and other openings which may emit inflammable vapor provided with 20x20 mesh brass wire screen or its equivalent, so attached as to completely cover the openings and be protected against clogging; these screens may be made removable but should be kept, normally, firmly attached. Manhole covers when equipped with suitable gaskets may be kept normally locked down and need not be provided with screens. Such a tank must be properly vented or equipped with a suitable safety valve set to operate at not more than five pounds per square inch for both interior pressure and vacuum; manhole covers kept closed by their own weight only will be considered satisfactory.

3. Tanks used with a pressure discharge system must have a safety valve set at not more than one-half of the pressure to which the tank was originally tested.

4. Any tank located within 200 feet of a track over which passenger trains are moved and not on ground sloping away from railroad property must, when practicable, be protected by dikes of earth, or concrete, or other suitable material, so that any liquid escaping from the tank will be held or diverted away from railroad property.

General

1. In measuring distance from any

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low. The high tension arc has normally a negative characteristic and as the current increases, the voltage across the gap decreases. The increased current means an increased temperature in the arc and sonsequently a greater velocity of the particles, ironization increases and the resistance drops. In order to make the arc more stable a fairly high impedance must be used. The resistance of such an impedance should be low and the heat losses minimized. With properly designed impedances, any change of current may be checked and a stable arc obtained, in some instances with such an impedance the current can be increased sufficiently to cause the characteristic of the arc to change sign and become positive, whereby an increase in current is accompanied by an increase in voltage. The power-factor of the arcs used for the decomposition of natural gas varied from 0.3 to 0.65. The low power factor could, in practice, be corrected by a suitable synchronous condenser or motor, thereby decreasing the abnormally large k. v. a. installation required for such a plant.—U. S. Bureau of Mines, Reports of Investigations.

ELECTRICAL DECOMPOSITION OF NATURAL GAS

	C8	C9	C10	C11	C12	C13
			Run No.			
Primary amperes	3.0	4.0	3.0	6.0	7.0	10.0
Primary volts	102	102	102	102	102	102
Indicated watt-hours	306	408	510	612	714	1020
Actual watt-hours	70	95	128	140	165	232
Power factor	.228	.228	.228	.228	.228	.228
Time of run, minutes	23.05	24.23	25.83	25.95	26.25	34.00
Cu. ft. of gas treated	.451	.350	.399	.320	.316	.316
Total carbon recovered, grams	.1300	.2290	.4991	.6547	.7434	.918
Carbon; lbs./1000 cu. ft. of gas	.635	1.442	2.75	4.50	5.19	6.4
K. w. h. per lb. of carbon recovered	94.0	76.0	50.2	41.8	44.2	65.0
			Run No.			
	C14	C15	C16	C17	C18	C19
Primary amperes	6.0	6.0	6.0	6.0	6.0	6.0
Cu. ft. per minute	.0044	.0088	.0117	.0127	.0177	.0235
Carbon; lbs. 1000 cu. ft.	9.30	6.35	4.50	4.01	2.30	1.15

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railroad track the nearest rail shall be considered as the starting point.

2. During the time that the tank car is connected by loading or unloading connections, there must be signs placed on the track or car so as to give necessary warning. The party loading or unloading the tank car is responsible for furnishing, maintaining and placing these signs, and the same party alone has authority to remove them. Tank cars thus protected must not be coupled to or moved. Other cars must not be placed on the same track so as to intercept the view of these signs, without first notifying the party who placed the signs. Before these signs are removed, even temporarily, the party authorized to move them must securely close the outlet valve of the tank car. The outlet valve must not be opened until the car is properly protected by signs. Such signs must be at least 12x15 inches in size and bear the words "STOP—Tank Car Connected!" or "STOP—Men at Work," the word "STOP" bein in large letters at least 4 inches high and the other words in letters at least 2 inches high. The letters must be white on a blue background.

These requirements are in conformity with Rule 26 of the American Railway Association train rules for single track, quoted below:

"A blue signal displayed at one or both ends of an engine, car or train, indicates that workmen are under or about it; when thus protected it must not be coupled to or moved. Workmen will display the blue signals and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to intercept the view of the blue signals, without first notifying the workmen."

3. Existing above ground pipe lines on railroad property for the loading or unloading of tank cars should, if required by the railroad in the interest of safety, be laid underground. If practicable these pipe lines should be laid a depth of at least three feet, and at points where such pipe lines pass under tracks they should be laid at least 4 feet below the bottom of ties.

4. All connections between tank cars and pipe lines must be in good condition and must not permit any leakage. They must be frequently examined and replaced when they have become worn in order to insure at all times absolutely tight connections. Tank cars must not be left connected to pipe lines except when loading or unloading is going on and while a competent man is present and in charge.

5. Except when closed electric lights are available the loading or unloading of tank cars on railroad property shall not be permitted except during daylight when artificial light is not required. The presence of flame lanterns, nearby switch lights or other exposed flame lights or fires during the process of loading or unloading is prohibited.

Washington, D. C.—The United States shipping board's contract for fuel oil with the General Petroleum Company of Los Angeles has been extended, so that delivery of 100,000 barrels will be made during the next six months at Buenos Aires.

Bureau Compiles Table Giving Properties Of Gulf Coast and South Louisiana Crudes

Washington, D. C.—The Bureau of Mines has recently completed a survey of the physical and chemical properties of typical crude oil of Southern Louisiana and Southern Texas, or what is known as the Gulf Coast field. Results of this survey are presented as the seventh in a series of reports covering different fields in the country. Fields previously reported are the Eastern and Rocky Mountain fields; the fields of Northern Texas, Northern Louisiana and Arkansas; Kansas, and Oklahoma.

In the present investigation the Gulf Coast crudes have been found to present some striking differences from those of the other fields. In the Gulf Coast district, on account of its peculiar geologic formations, it is difficult to obtain samples that adequately represent the wide areas. The oil-bearing sand masses are small in extent, lenticular, and steeply tilted, so that a sample from one well may not be representative of another well or wells not far distant, for the wells may be producing from entirely different formations. However, the samples obtained are thought to be fairly representative of average conditions for the district.

Of the 38 samples, only six had gravities lighter than 30° A. P. I (Baume based on modulus 141.5). Five of them were evidently light oils, more resembling the Mid-Continent than a true Gulf Coast oil; the other was a Gulf Coast oil, but contains more gasoline than usual. Five other samples had gravities between 25° and 30° A. P. I., nineteen between 20° and 25°, and seven below 20°.

The sulphur content varies widely. One "freak" sample gave only 0.12%; nine, between 0.2 and 0.3; ten, between 0.3 and 0.4; eight, between 0.4 and 0.5; four, between 0.5 and 0.6, and three, between 0.6 and 0.7%; while three showed 1.40, 1.90 and 2.23%.

Pour tests were almost uniformly low, although the viscosities were fairly high, some exceptionally high.

A striking peculiarity is the almost complete lack of gasoline fractions.

The Gulf Coast crudes are evidently "naphthenic" in character, and except for the five light oils, have a family resemblance among themselves, and differ from those of any other field examined.

The crudes examined may be classed into (1) light oils, similar to Mid-Continent crudes; (2) typical Gulf Coast oils containing no gasoline or naphtha, and having vacuum distillates of moderately high viscosity; (3) typical Gulf Coast oils containing some gasoline or naphtha, and (4) heavy Gulf Coast oils, with vacuum distillates of exceptionally high viscosity. The more viscous oils are produced from the shallower sands. While the oils are "naphthenic" in character, they are not necessarily high in asphaltic content.

A complete copy of serial No. 2416 containing extensive tables on the analytic work on these Gulf Coast crudes can be obtained by writing the Director, Bureau of Mines, Washington, D. C.—Reports of Investigations, U. S. Bureau of Mines.

Bureau of Mines Issues Paper Showing New Specifications for Crude Products

Washington, D. C.—Federal specifications and testing methods covering various petroleum products are given in Technical Paper 323, just issued by the United States Bureau of Mines. The specifications cover motor gasoline, aviation gasoline, naphtha, kerosene, lighthouse kerosene, signal oil, fuel oils. fuel oil for Diesel engines, bunker fuel oil, and lubricants. Under the general heading of lubricants, special specifications are given for aircraft machine gun oil, car and locomotive oil, cup grease, Diesel engine lubricating oil, floor oil, gun and ice-making oil, paraffin wax, electric switch oil, rust preventing compounds, etc.

The testing methods outlined include color tests, cloud and pour tests, determination of viscosity, melting points, flash points, water and sediment, sulphur, etc.

The specifications given were recommended by the Interdepartmental Petroleum Specifications Committee, of which N. A. C. Smith, petroleum chemist of the Bureau of Mines, is chairman, and have been officially adopted by the Federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of materials covered by them. The Interdepartmental Petroleum Specifications committee was assisted in the preparation of the specifications by an advisory board consisting of representatives of several engineering and technical societies.

Technical Paper 323 may be obtained from the Superintendent of Documents, Washington, D. C., at the price of 10 cents.

Refiners Change Meet at Galveston to April 10-12

Kansas City, Mo.—Due to a conflict in convention dates with the National Petroleum Marketers Association, the annual meeting of the Western Petroleum Refiners Association will be held in Galveston, Texas, April 10, 11 and 12, instead of the previously announced date of March 6, 7 and 8.

John D. Reynolds, secretary of the Western Petroleum Refiners Association, advises that an interesting program is being arranged for the Galveston gathering and that preliminary announcements will be forthcoming shortly.

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The Use of Sulphuric Acid in Oil Treatment

Despite fact that method is oldest known much is yet to be learned about this type of treating

The use of sulphuric acid in refining petroleum distillates is almost as old as the oil industry itself. This acid was used in the refining of coal oil by Gower as far back as 1792 and was adopted by the petroleum industry about 60 years ago. Despite the many years that have elapsed since then, the chemistry of the sulphuric acid treatment is still far from being fully understood. What takes place during the process is so complex that it taxes the imagination even to conjecture all the possible type reactions, much less actually to observe or measure them with any degree of accuracy. Much work has been done in the study of this process by many investigators and the results of some of this research are given here.

Very briefly put, the refining of distillates with sulphuric acid is accomplished by mixing the acid with the oil generally in several doses, by means of air or mechanical agitation. The sludge, consisting largely of reaction products, is drawn off and the oil neutralized with caustic soda or other alkalis. It is finally washed with water to remove the excess of alkali and the alkaline reaction products, and the chemical refining is complete. In actual practice this system must be modified to suit the needs of the particular oil being treated.

The kind of acid treatment to be used depends almost entirely on the constitution of the distillate. Several general rules may be formulated, viz:

1—The higher-boiling the fraction the more rigorous the treatment necessary to obtain a certain color or degree of refinement.

2.—The quantity of acid required decreases with the narrowness of the fraction.

3.—Cracked distillates require more treatment than do the natural distillates.

Let us consider a typical case to show the relationship between the boiling point range of a distillate and the quantity of acid used in refining it. Two fractions were cut from a California crude. Oue was a kerosene distillate with a gravity of 38.5 degrees Baume. The other was a lubricating distillate of 22.2 degrees Baume. Both were about equally narrow fractions and were to be refined to a water-white color. The kerosene was given a total of 23 pounds of fuming acid and four pounds of 66 degree Baume sulphuric acid per barrel. The lubricating distillate, on the other hand, received 335 pounds of fuming and 20 pounds of 66 degree acid per barrel, and finally was filtered in order to get the water-white color.

Two oils may have almost identical physical constants and yet differ very greatly in their make-up. This is illustrated by two lubricating oils with the following physical properties.

Oil No. 1	Constants	Oil No. 2
476	Saybolt viscosity at 100 deg. F.	462
365	Open-cup flash test	380
425	Open-cup fire test	435
No. 6½	NPA color test	No. 6½
24	Cold test, deg. F.	20
18.0	Baume gravity, deg.	19.7

Oil No. 1 is a heavy California motor oil which consists of a very large fraction of lubricating distillates reduced to the proper viscosity and flash test. Oil No. 2 is a widely used brand of motor oil, also made in California, and consisting of a quite narrow cut run to specification and treated without further reduction. As shown above, their tests are practically the same. Yet oil No. 2 requires only an average of 31 pounds of acid per barrel for treatment, while No. 1 requires 47 pounds. Neither fire and steam distillation in conventional cylinder stills manipulated in practically the same manner.

Cracked motor fuels invariably need treatment to remove objectionably smelling compounds. Also, they usually acquire a dark color quite rapidly when exposed to air. These oxidation products or the bodies from which they are formed must also be removed in order to give the distillate a marketable color or rather lack of color. On the other hand, most motor fuels which are not cracked, such as straight-run gasoline, for instance, can be sold as finished products directly after distillation and without chemical treatment. If a chemical treatment is given it consists of just a small amount of sulphuric acid or perhaps only an agitation with sodium plumbite solution.

Cracked gasolines are hard to refine as compared with the natural product. Fortunately, due to lessened use and an increased supply of crude, it is not longer necessary to make cracked kerosene, at least in the United States.

Lubricating distillates are difficult to treat when in the best of condition. Cracked lubricating oils require a great deal more acid to bring them to a stable color than do those distillates in which cracked products are at a minimum. In fact, it is often absolutely impossible to refine a badly cracked lubricating oil.

Strength of Acid Used.

While it is true that sulphuric acid in relatively dilute form (not less than 65 per cent sulphuric acid or 52 degrees Baume) can be used successfully in the treatment of certain distillates, it has become general practice in the industry to work principally with two concentrations. Sulphuric acid of 66 degrees Baume (specific gravity 1.84 or 167 degree Tw., 93 per cent sulphuric acid) is used in refining most of the world's petroleum. In special cases 98 per cent sulphuric acid (specific gravity 1.850) is used. This has been found to be better than 66 degree acid for the refining of certain California distillates, particularly lubricants. In the making of high-grade kerosene or of water-white medicinal oils fuming sulphuric acid is used. This is generally of the 15 per cent sulphurtrioxide form (about 103 per cent sulphuric acid), although acid with 20 per cent free sulphur trioxide is sometimes used. There have been developments within recent years of the use of sulphur trioxide gas directly from the acid plant, but this could certainly not be called general practice.

There are two reasons why acids of such high concentrations as those just mentioned are used. In the first place, the quantity required to achieve a certain result in refining increases very rapidly the lower the concentration. Secondly, the more dilute the acid the more troublesome it is to ship and store. In fact, as is well known, sulphuric acid of less than 60 degrees Baume cannot be shipped commercially in iron tanks.

The relation of acid concentration to results obtained is well illustrated by the following figures. A partly cracked distillate (specific gravity 0.8245) was treated with acids of various concentrations. In all cases the temperature was 64 degrees F. at the start. The amount of acid used in each treatment was 2.5 per cent by weight.

Tests on Oil

Strength of Acid in per cent H_2SO_4					
After Treatment	70	93	96	99	103 (15 Per Cent Fuming)
Saybolt, color, inches	10.5	17	20	25	22
Iodine No., Wijs ...	16.3	7.2	2.6	1.3	0.65
Doctor test	*	*	†	†	†

*Sour.
†Sweet.

It is clear from the above table that the refining action increases much more rapidly than the concentration of the acid. The only figure which is out of line is the darker color obtained with the fuming acid (103 per cent sulphuric acid as compared with that given by 99 per cent acid. This is often found to be the case and can be readily explained. Fuming sulphuric acid acts primarily by sulphonating and oxidizing unstable hydrocarbons rather than by polymerising them. Many of these sulphonation products are soluble in the oil and consequently impart to it a darker color. As these products are more readily soluble in concentrated sulphuric acid than in oil, the practice has been developed of agitating with a small amount of 66 degrees Baume acid (93 per cent sulphuric acid) an oil which has been treated with fuming acid. In this way excellent color can be obtained.

Use of Sludge and Regenerated Acid

Only a part of the acid used in refining is used up in the process. For instance, a sludge from a typical California kerosene treatment with 66 degree Baume acid had a Baume gravity of 46.0 degree (Sp. gr. 1.47) and contained 64 per cent of sulphuric acid and 24 per cent of hydrocarbons. The sulphuric acid from such suldges is often regenerated and used for various purposes.

Where the fresh acid is given in several doses to the oil being treated and the sludge is drawn off after every agitation, the last one or two drainings frequently consist of fairly pure and concentrated acid. These drainings

can be used to advantage in treating the next batch of oil, either as so-called "water acids" to remove any moisture in the oil or as a first dose of "acting acid" to aid in the refining.

Regenerated acid—this is, sludge acid from which water and organic substances have been removed as far as possible—does not usually lend itself well for further use in refining except in the manner indicated above for relatively clean sludge. At the present time considerable work is being done on the subject of acid recovery. Several very clever processes have come into use and the near future will probably see a commercial and generally acceptable method for making a really pure regenerated acid.

Quantity of Acid

The desired results in refining with sulphuric acid cannot be obtained simply by using larger and larger quantities of acid. There is a very definite limit beyond which it is no longer feasible to use additional amounts of acid. This limit is set by the following considerations:

(1) The refining power of the acid is not proportional to the quantity used. In fact, it diminishes very rapidly, as is shown by figures obtained in the treatment of a California lubricating distillate from Coalinga crude:

66 deg.

Be. acid used (% by weight)	Color of finished oil (NPA Scale)
5	5
10	3
15	2
20	1½
50 (including 30% fuming acid	1

(2) If too much acid is used the distillate is apt to be "burnt". By this the practical refiner means that the treatment has been so rigorous that those delicate and probably aromatic compounds which give a pleasing "outer-tone" or fluorescence to the oil have been destroyed. This applies mostly to lubricating oils, since in refining light distillates one of the principal objects is to remove all traces of color, even of "outer-tone." An acid-burned oil generally has a dirty, brownish or bluish tinge.

(3) The more viscous the oil the more liable it is to the formation of emulsions. These emulsions are usually the result of a heavy acid treatment. An emulsion is a serious problem and when broken almost always yields a darkened oil and a large loss.

Acid in Doses

It is general practice to apply the acid used in treating in several doses. There are several very good reasons for this. In the first place, most oils are treated at as low a temperature as possible. If sulphuric acid, especially fuming, is mixed with the oil in large quantities the heat of reaction will probably raise the temperature too high. Secondly, most distillates contain a certain amount of free water or at least moisture. If this should be permitted to dilute all the acid, its effectiveness would be materially reduced. Therefore the first dose, or "dump" as it is generally called in practice, is used to remove this water. The succeeding doses can then act on the oil at their original concentration. Thirdly, aside from the question of dilution by water it has been found that a fixed quantity of acid has considerably greater refining power when applied in several small doses rather than in one large one. Since the action of the acid on the oil is partly a solvent action, this behavior is in keeping with the well-known physicochemical principles of solutions.

Effect of Temperature

The temperature at which the acid treatment is carried out is an extremely important matter. A general rule followed by most refiners is to treat at just as low a temperature as possible. This rule is based on the fact that one of the principal objects in refining most petroleum distillates is to make them as nearly colorless as possible, and this can best be done at low temperatures. The lack of color in an oil does not necessarily indicate a high degree of refinement. However, the trade is prone to judge an oil by its appearance and often blindly assumes that the best looking oil is really the best. This is equally true of light oils such as motor fuels and of lubricating oils.

Mixing Acid and Oil

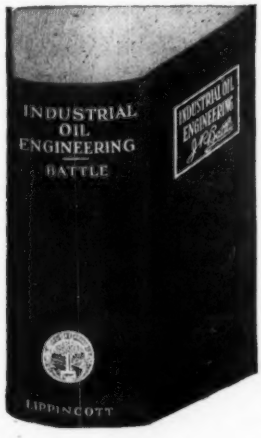
Three methods of mixing chemicals with the oil being treated are used in practice. The one used originally was mechanical and is illustrated by the gear-driven paddles used in grease kettles. Mechanical agitation is at present used only in special cases, mostly when oxidation by air is to be avoided. In most treatments the acid is now mixed with the oil by means of an air blast. In this way rapid, thorough and relatively cheap diffusion of the acid through the oil is obtained. Air agitation, however, has its drawbacks. First, it oxidizes the oil. This is a serious consideration in the case of cracked distillates or oils being treated at elevated temperatures. Second, the air almost always contains considerable water. This dilutes the acid and greatly reduces its efficiency. Third, when light distillates are agitated with air, the evaporation losses are prohibitive. Consequently oils like gasoline are mixed with the acid or other substances by means of a circulating pump. This takes suction near the top of the agitator and pumps the oil in at the bottom.

The Time Factor

The length of time required to utilize the full refining value of the acid depends on a number of modifying circumstances. Among these the most important are:

(1) Method and violence of agitation. (2) Size and shape of the apparatus. (3) Viscosity of the oil. (4) Quantity of acid used and number of dumps in which it is applied to the oil.

When the oil is being treated in separatory funnels in the laboratory, a few minutes violent shaking by hand generally suffices. In agitators of 500 barrels to 2,000 barrels capacity light distillates are usually agitated by air for periods varying from 15 minutes to one hour. If circulation by pump is used as a method of mixing, the time is increased to as much as 16 hours or more. The time limit in acid-treating lubricating oils may be defined more closely. It is safe to say that the average large-scale batch varying, say, from 25 to 1,200 barrels cannot be intimately mixed with acid in less than half



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RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C. —The following patents of interest to the oil refining industry have recently been issued by the United States Patent Office:

Purifying Hydrocarbons

No. 1,441,417, issued on January 9 to David F. Gould, assigned to The Barrett Company, a corporation of New Jersey, on a method for the purification of hydrocarbons. The process comprises agitating impure molten naphthalene with concentrated sulphuric acid, drawing off the acid, cooling, permitting the naphthalene to solidify, comminuting the solid mass and washing it.

Treating Shale

No. 1,441,542, a patent on a method of treating oil-bearing shale, issued on January 9 to Halver R. Straight, Adel, Iowa. The patent comprises a method of treating oil bearing shale which consists in first heating the shale to such temperatures as will remove the more volatile ingredients, then depositing them in a closed container, and then supplying oxygen in measured quantities to the interior and central portion of the mass of heated shale, then agitating the material about the point which the oxygen is supplied by rotating the same, for utilizing the combustible properties of the shale to further raise the temperatures to a high degree, and to prevent the mass of material from fusing together while the less volatile ingredients are being liberated.

Distill Crude

No. 1,442,935, a patent on an apparatus adapted to distill crude petroleum, issued on January 23 to Chauncey B. Forward, Urbana, Ohio, comprising an oil pump, separate sets of compact coils of pipe of great length connected in series with said pump and each other, separate enclosing cylinders for said coils of pipe having open communication with each other and providing separate large steam chambers, means adapted to deliver a continuous supply of superheated steam to said cylinders inversely to the flow of oil through said pipe, a closed vapor and liquid separating vessel, means adapted to deliver the heated oil from said coils of pipe together with steam into said vessel, separate vapor and liquid discharge connections for said vessel, means in each of said discharge connections adapted to control pressure conditions within said vessel under the force of the steam and oil discharged thereinto, and a condensor connected with the vapor discharge connection.

Oil Emulsions

Oils, particularly mineral and tar oils, are subjected to a high-speed disintigration in a colloid mill in presence of water and of an insoluble mineral solid, e. g. colloidal graphite, calcined magnesium oxide or magnesium carbonate. Talc or graphite may be added to increase the consistency of the product. Pastes are obtained when not more than six parts of water to one part of oil are employed; liquid emulsions when the water exceeds this proportion. The products are suitable for use as lubricants.

British Patent 185,779, to Plauson's (Parent Co.) Ltd.

Fort Worth, Texas. — The Central Texas Petroleum Company, a subsidiary of the Central Gasoline Producing Company of Cincinnati, Ohio, has established offices on the nineteenth floor of the W. T. Waggoner building in this city with A. C. Taylor and George P. Gleeson in charge. The former company will market the output of the parent organization's absorption gasoline plant in Stephens County, Texas, and has contracted to handle the products of several other gasoline and skimming plants in Texas.

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an hour. Complete mixing should be attained in two hours, at any rate. Needlessly prolonged contact between the acid and the oil is harmful. This is because part of the sludge will dissolve in the oil and thus discolor it. Also, long agitation of acid lubricating oils frequently results in emulsions after the addition of an alkali solution as in the ordinary method of treating. While this is true no matter by what means the oil is agitated, it must be borne in mind that the influence of air is especially bad because of its oxidizing effect.

For a long time the separation of the acid sludge from the oil in which it is suspended was a serious problem in oil refining. Of course, the light oils have such a low viscosity and specific gravity that the heavy viscous sludge settles out almost immediately. Such, however, is far from being the case with lubricating oils, especially the more viscous ones.

Formerly the oil was freed from sludge either by long settling or by centrifuging. The former method injured the oil because of the length of time in which it had to remain in the acid condition. The latter procedure was very expensive and the lead-lined centrifuging. The former method in need of repair.

During the last 25 years it has become universal practice to "knock down" the sludge from the acid-treated oil. This practical expression really means that the very finely divided sludge particles are gathered together into methods sufficiently heavy and compact to settle out of the oil. This result is accomplished by sprinkling cold water or caustic-soda solution on the oil while agitating it very gently. Before the sludge is "knocked down" the oil has a color ranging from blue to purple. The oil is more purple when it has been treated with a large amount of acid. After all the sludge is gathered and precipitated the oil takes on a color ranging from green to yellow. The acid treatment is now complete and the oil is ready to be neutralized.

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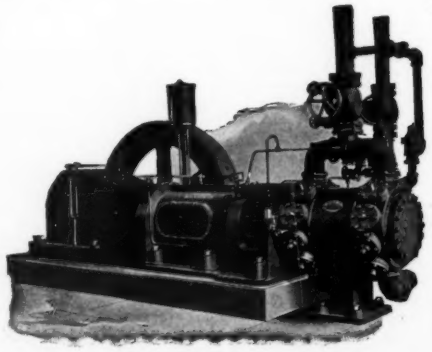

PERSONNEL OF THE INDUSTRY

J. W. VAN DYKE
President of the Atlantic Refining Company, Philadelphia, Pa.

E. W. Long now is the Southwestern representative of the Calorizing Company of Pittsburgh, succeeding T. D. Hintz, resigned. The Southwestern territory comprises Kansas, Oklahoma, Texas and Mexico. Long was formerly connected with the engineering department of the Gulf Refining Company at Port Arthur, Texas, and is well known in refining circles in the Mid-Continent.

The Standard Seamless Tube Company, Pittsburgh, Pennsylvania, will have a new plant completed about the first of May, doubling their capacity, and T. L. Kirk, sales manager, says his company will then be in a much better position to care for the increasing demand for Standard Seamless Steel Tubing.

George P. Gleason of the Fort Worth offices of the Central Texas Petroleum Company was a business visitor in Houston early this week.

Before leaving Tulsa for New York, John L. Gray, president of the Barnsdall Refining Company, announced that he had appointed H. L. Hughes, heretofore assistant sales manager, to the position of sales manager, and J. C. Evans, chief clerk, sales department of Tulsa office, to assistant sales manager, and W. Wiley Rice, chief clerk sales department of Chicago office, to assistant sales manager, all of the above officers reporting to Geo. D. Locke, vice president, Chicago, Illinois.

H. C. Born, assistant to the president of the Montrose Oil Refining Company, Inc., Fort Worth, Texas, and who has been connected with the above company for the past four years, announces that he has resigned his position, effective February 1. Mr. Born was actively in charge of the Fort Worth office and the refinery operations, under the direction of the president, W. R. Spann. At the present time he has not announced any future plans or connections, but will take an extended vacation of several months, making a trip to the East and also to California

E. W. Long, who is in charge of the Central West territory for the Calorizing Company, was in Houston during the past month. The company will open an office in Houston and possibly some of the other important refining centers.

Dr. Charles K. Francis has resigned as chief chemist and technology superintendent of Cosden & Company and will soon enter the employ of the Producers and Refiners Corporation. Dr. Francis has been with the Cosden company for five years, coming to Tulsa from Stillwater, Oklahoma, where he had charge of the state experiment station. He is one of the foremost authorities in the United States on chemistry and its relation to the petroleum industry.

William O. Schock, president of the Indiahoma Refining Company of Okmulgee and St. Louis, was married in the latter city January 3 to Mrs. Lida Crawford Carr. Immediately after the ceremony Mr. and Mrs. Schock departed for New York and other eastern points.

S. R. Lawing, crude buyer for the White Eagle Oil and Refining Company in the North Texas district with headquarters at Wichita Falls, Texas, made a trip down to Fort Worth during the month.

George N. Moore, president of the Moore Refining Company, is still at the company's plant at Arkansas City and states that he will probably remain there for several weeks yet.

H. J. Strief, president of the Primrose Refining Company, has returned to his offices at Wichita Falls, after a trip to the east during the latter part of January.

Announcement has been made by the Barnsdall Refining Company of the appointment of H. L. Hughes, formerly assistant sales manager in Tulsa, as sales manager. J. C. Evans, chief clerk in the sales department in Tulsa, has been promoted to be assistant sales manager, as has W. W. Rice, who has been chief clerk in the Chicago sales department of the company.

R. R. Irwin, vice president and general manager of the White Eagle Oil and Refining Company with headquarters at Kansas City, inspected the company's refinery at Fort Worth early this week.

Hoyt Sherman, special representative of the New England Oil and Refining Company, Falls River, Mass., was in Houston during the past week in the interest of the company.

L. C. Rhoades, manager of the branch office of the Bessemer Gas Engine Company at Ranger, Texas, has been transferred to Fort Worth and made district manager following the transfer of District Manager B. L. Potter to Tulsa offices.

Roy B. Jones, president of the Panhandle Refining Company with headquarters at Dallas, Texas, left for Washington early in February where he was scheduled to appear before the senate investigating committee.

Elliott Jones, president, and Jack Pape, sales manager of the Elliott Jones and Company, incorporated, of San Antonio, were in Dallas early in February on company business.

A. W. Peake, with the Midwest Refining Company, is enjoying a brief stay in California, where he is visiting Mrs. Peake, who is spending the winter in that state.

Major A. M. Risdon, formerly of the engineering department of The Texas Company, has resigned his position with that company to become southwestern district manager of the Calorizing Company with headquarters in Houston.

Walter Miller, refinery expert for the Marland Refining Company, was a visitor in New York during the past month.

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NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS

New Barreling Method Enables Uniform Package; Also Is Time Saver in Filling

A method has recently been evolved which enables barrelers to know the exact quantity of liquid that will be put into a barrel before the liquid has started to flow. This quantity can be the exact amount desired. This means that every shipment from the plant in which this system is used will be a shipment of uniform package, that every barrel will be accurately filled.

The manufacturers of the device used in this system have demonstrated that it will enable users of the system to barrel liquids as fast as the products would flow into the containers, and with a saving of product, time and labor and a complete avoidance of spillage and elimination of claims for shortage.

The system consists of a unique scale which measures the contents of barrels while they are being filled with liquids and automatically cuts of the flow when the contents of the barrel reaches the desired weight. By a patented revolving feature the scale uses two opposite and identical arms. Each arm is, within itself, a complete and accurate scale unit. One arm is always in position for changing a barrel, while the other arm holds a barrel under the filling spout.

In operation an empty barrel is fixed on one side of the scale. Each side of the scale is equipped with a double bladed beam. The operator sets a poise weight on the upper blade to balance the exact tare weight. The poise weight on the lower blade is set at the exact net weight of the liquid desired in the barrel. The double bladed beam shows the tare, net, and gross weight at a glance.

The scale is revolved on a ball bearing base, bringing the empty barrel to the filling spout. This base has a locating catch which stops the scale so that the bung of the barrel is under the filling spout in the exact position for filling. The flow into the barrel is started by the opening of the valve. This valve is held open by a handle latched into an automatic trip.

While the barrel is filling, the operator can work elsewhere. When the contents of the barrel has reached the predetermined quantity, the beam actuates, making an electrical contact which closes the circuit, releasing the valve lever and shutting off the flow of liquid. The action of this mechanism is instantaneous and positive. The supply stops when the predetermined amount has entered the barrel. Spillage is entirely avoided.

When the supply has been automatically shut off, the scale is revolved, bringing the empty barrel into filling position and carrying the filled barrel around to where it can be changed for an empty.

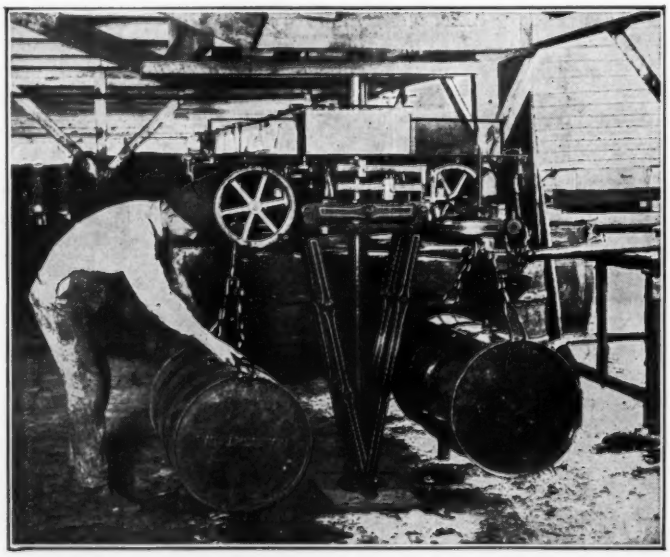
The unusual accuracy obtained by the use of this scale is profitable to both shippers and their customers. It permits a barreler to stencil the barrels before they are filled, with the knowledge that the quantity stenciled thereon will be the exact net contents.

The Sawyer Specialty Scales Company, manufacturers of this device, supply a stencil with every scale. This stencil reproduces the words: "Contents Certified, Gallons.....Net..... Pounds — Sawyer Automatic Fluid Scales — Claims Eliminated," with a space for the shipper's name, product, etc.

One large oil company who uses this system has stated that if a claim were made for shortage in barrels filled on this scale, this claim would not be entertained. This statement was made in view of the fact that they have had no shortage claims since this method has been employed in their barreling operations. The personnel of their claim department has been given other duties.

This improved method decreases cost by increasing capacity. Its capacity is limited only by the speed with which the liquid will flow through the bung of the barrel. The supply valve is closed only during the few seconds in which the scale is revolved. Thus, the flow is almost continuous.

The predetermined contents, which permits a uniform package, effects ad-



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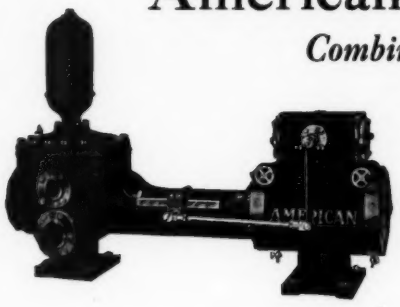
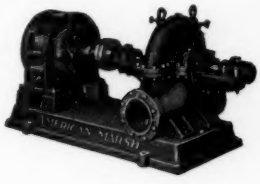


American-Marsh Pumps meet the demand for strictly high grade high efficiency units where absolute reliability over a long term of years is essential. Their heavy, rugged construction with extra wide passages and large valve areas make them ideal for handling oil and other heavy liquids.

The steam pumps are fully bronze fitted. Heavy cradle yokes are furnished between steam and water ends instead of tie rods, making expensive drip pans unnecessary.

American-Marsh Centrifugal Pumps are made in many different types, some of them especially designed for refinery work. Capacities range from 5 to 5000 gallons per minute and heads up to 250 feet.



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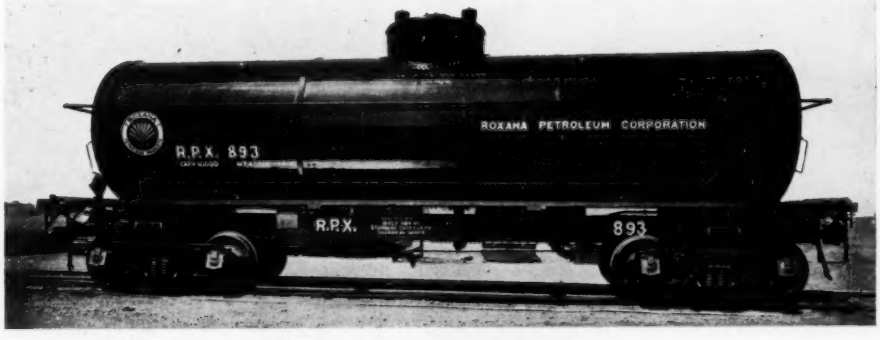

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ditional economy. It obviates clerical work in every department. Whether 10 barrels or 10,000 barrels are filled, each department knows that every container is uniform. For example, the invoicing department does not need to receive from the shipping department a tabulated record of each barrel shipped to individual customers, but merely a statement that 50 barrels containing exactly 50 gallons were shipped. Then the invoicing is a simple matter of multiplying the contents of one barrel by the number of barrels in the shipment.

Chicago, Ill.—Orders already booked by the General American Tank Car Company for 1923 for both freight and tank cars are in excess of $25,000,000.

Recent Books

Among a number of recent additions to the literary branch of the industry are found the following books which should prove of interest to refiners and gasoline manufacturers: The Elements of Fractional Distillation; Technical Gas and Fuel Analysis, and American Sulphuric Acid Treatment. These books are edited by recognized men of the industry and contain some very valuable information on their subjects.

The books are being offered to the trade through the GULF PUBLISHING COMPANY, Houston, Texas, which announces that full particulars can be secured by writing the company direct.

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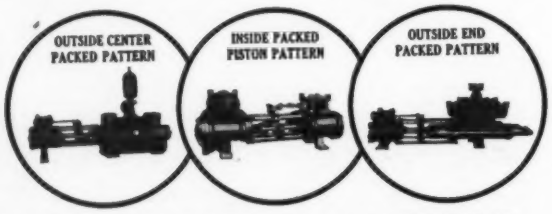

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Ordinary oil tests are unsatisfactory for determining lubricating values because they show neither the thickness of the film nor the displacement of the mechanical alignment. Two methods are given for the measurement of the thickness of films. (1) On the front surface of the journal of a shafting is drawn a cross-hatched lattice with lines 0.002 mm. apart. On rotation, the point of intersection of the axis of the shaft with the plane of the lattice appears as a fine point. The displacement of this point is measured by a microscope with ocular micrometer. This is usually 0-0.1 mm. (2) The displacement of the shaft is measured both tranversely and longitudinally by a photomicrographic method with a collimator, the optical axis being tangential to the shaft. Considerable differences in displacement were found for various types of lubricants.

More Railway Companies Turn to Use of Fuel Oil

St. Louis, Mo.—Coal operators in the Southwest are complaining of being hard hit by the recent decision of several railroad companies to turn to the use of oil as fuel.

The Missouri Pacific and the St. Louis Southwestern (Cotton Belt) railroads are going to avail themselves of the opportunity to obtain sufficient Smackover, Arkansas, crude while the St. Louis-San Francisco and the Rock Island are abandoning quite a number of their coal contracts in Arkansas and Oklahoma. The Rock Island's coal consumption is estimated at 650,000 tons a year and the decision to turn to oil will mean the abandonment of the Rock Island mines at Harthorne and Alderson, Oklahoma.

The Cotton Belt is understood to be converting its engines into oil burners for all territory south of Pine Bluff. The Frisco now has about 70 oil burning engines in service.

Discharge of Oil in Water Made Unlawful

Washington, D. C.—The House Committee on Rivers and Harbors has entirely rewritten the bill prohibiting the pollution of waters of the United States by oil, so as to specifically make the discharge of oil and oil refuse into navigable waters unlawful and in such manner so that there will be no question that the pollution of oil does not have to impede or obstruct navigation.

The original bill, as passed by the Senate, covered only the navigable waters, while the new measure would cover any waters, navigable or tributary of any navigable waters. Under the committee's version of the measure, the administration of the act is placed with the Chief of Engineers of the War Department.

Correction

In the January issue of THE REFINER we stated that the plant of the Prairie Refining Company was shut down when the plant should have been listed as operating.

REFINERY AND GASOLINE PLANT ACTIVITIES

Narrow Margin Causing North Texas Plants To Strive for Increased Gasoline Recovery

Wichita Falls, Texas.—In order to prolong the life of a skimming plant during these days when the spread between the cost of crude and refinery operation and the net return from sale of refined products is reduced to a narrow margin on an average over the year, the independent refiners in the North Texas district are striving to bring up their recovery of gasoline and at the same time increase the general efficiency of their plants. Plant superintendents as a whole in the district are showing a far greater per cent of gasoline yield from crude than was the case during the same month one or two years ago, and have succeeded in reducing their losses over the month to a minimum due to the installation of modern equipment, and slight changes in the method of running the raw product through the plant.

The Panhandle Refining Company's 4500 barrel daily capacity skimming plant located on the outskirts of Wichita Falls is being overhauled and equipped with a set of fractionating treating towers at an expenditure of approximately $25,000 that is expected to boost the present all year round average recovery of 33 per cent on Burkburnett crude an additional 10 per cent or more. This process was invented by Ira E. Eells, plant superintendent for the Panhandle Refining Company, and the company owns the patent. The process was only recently perfected, but was given a thorough trial before the company decided to install it in their plant. The two batch stills at the plant in addition to the six continuous stills are being converted to make a continuous battery of eight stills that will be equipped with double towers. The process is said to treat the product on the way to the tanks, thereby making reruns unnecessary, which will result in the daily output of the plant being materially increased as heretofore about 80 per cent of the light stuff had to be rerun.

The Panhandle Refining Company has a boiler shop adjoining its refinery and is building its own towers and other miscellaneous steel work. The outcome of the practical use of the fractionating treating towers is being watched with interest by other skimming plant owners in the North Texas district, and if it lives up to expectations other installments are apt to follow.

The daily capacity of the Iowa Park Producing and Refining Company's skimming plant located at Iowa Park will be increased from 1200 to 1500 barrels daily when the 10x30 foot extra heavy steam rerun still being installed is placed into service. This still is being added to bring up the efficiency of the plant rather than to increase the daily output.

H. E. Boner, independent owner of a skimming plant near the Receivership area in Burkburnett field, has completed the work of tearing down an old pipe still and substititing with a larger one, which has increased the capacity of the plant from 500 to 700 barrels daily.

The American Refining Company, which is operating its 5000 barrel capacity skimming plant near Wichita Falls about half capacity, is converting six steam stills into fire stills, and has announced that its entire output will be utilized within a few months. This plant is connected by pipe line to the Duncan, Oklahoma, oil field, in addition to having a line in the Burkburnett fields. The steam pumps at the plant are being stubstituted with electrically driven pumps.

The capacity of the State Refining Company's skimming plant at Grand Prairie, near Dalals, has been increased from 1200 to 1800 barrels through the addition of a fire still. A similar still has been ordered, and it is planned to have it installed by March 1, which will bring the capacity of the plant up to 2400 barrels.

The Oriental Oil Company of Dallas has been making extensive repairs to its plant No. 2, located on the edge of Dallas, and is expected to start operations shortly, with F. M. Floyd in charge. This plant was acquired by Oriental last September from a Dallas bank along with some producing properties in Central West Texas after it had changed ownership on several occasions. It has a capacity of 3500 barrels, and was originally known as the Eastland Oil and Refining Company, and later leased by the Aetna Petroleum Corporation. Then the Trinity Oil Corporation operated it for a few months before allowing it to revert back to the holders of mortgages on the properties.

Plans Are Made for New Plant at Eureka, Kans.

Wichita, Kans.—What promises to be the first refinery in Eureka, Kansas, is the proposed plant to be erected there by the Kansas City Refining Company, which owns ground on the Missouri Pacific railroad just east of the city limits. The Kansas City Refining Company operates a plant at Kansas City, Kansas, and it is understood that the Eureka project is calculated to relieve the other plant of any additional output.

Petroleum Jelly to Be Refined by New Plant

Pittsburgh, Pa.—The Chesebrough Manufacturing Company has announced the construction of a new plant near McKees Rock six miles below Pittsburgh on the Ohio River for the manufacture of vaseline and other products from petroleum jelly.

It is expected that the first unit of the plant will be in operation by April and other units will be completed according to plans.

Anglo-Persian Branches Out in European Fields

London, Eng.—It is learned here that the Anglo-Persian Oil Company has entered the oil distributing field in Italy, Germany and Holland and is selling through a subsidiary concern in Roumania and Turkey. It is understood that the refinery of an associated company in France is about completed and that extensions at Abadan and Llandarcy will be in operation by midsummer.

Anglo-Persian already has a well organized distribution in France, Belgium, Norway and Denmark.

Above is shown a portion of the new casinghead gasoline plant at Casper, Wyoming, just completed by the Producers and Refiners Corporation, at a cost of approximately $350,000. This plant, one of the largest absorption plants in the world, has been completed and in operation since January 8. Its capacity is 50,000,000 cubic feet of gas, or 10,000 gallons of gasoline a day. The natural gas handled by this plant is transported from "P. & R." gas wells in the Ferris and Wertz districts, 90 miles away, via a 10-inch, 12-inch and 14-inch pipe line.

XUM

November Gasoline Production Exceeds October—Near High Record of the Year

Washington, D. C.—Gasoline production in the United States continues at a near-record clip, the output for November coming within 2,600,000 gallons of the record monthly production figure attained in July, 1922, according to the United States Bureau of Mines. The November production amounted to 567,100,921 gallons, which is 1,000,000 gallons above the October output and 135,000,000 gallons, or 31.31 per cent above the production figures for November, 1921.

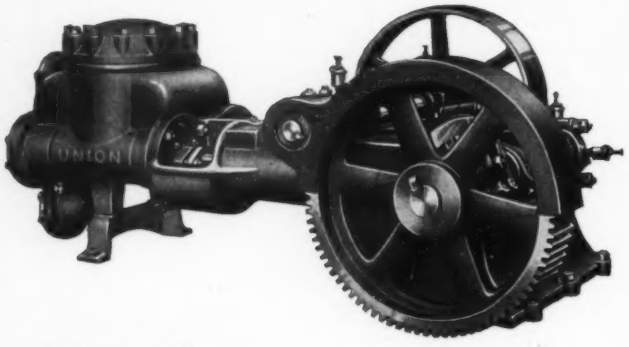
The demands of the nation's millions of internal-combustion engines continue to maintain gasoline consumption at a dizzy pace. Domestic consumption of gasoline in November amounted to 470,043,173 gallons, an increase of 120,000,000 gallons, or 34.09 per cent above the consumption figures for November, 1921. November gasoline consumption figures were, however, 19,000,000 gallons below the October consumption mark, due, doubtless to the advance of winter and the consequent curtailment of automobile activities. Stocks of gasoline on hand December 1 amounted to 776,723,619 gallons, an increase of 53,000,000 gallons during the month. Exports of gasoline in November were 41,085,149 gallons; shipments to insular possessions were 2,833,042 gallons.

During November 306 refineries reported to the Bureau of Mines as operating, and these ran through their stills a daily average of 1,473,449 barrels of crude oil and 157,922 barrels of other oils. The daily indicated capacity of these refineries was 1,869,820 barrels, an increase of 1.37 per cent over the previous month. Total oil runs to stills in November showed an increase of 2.86 per cent as compared with October.

Production of kerosene in November amounted to 234,436,275 gallons, an increase of 19,000,000 gallons over the figures for October and of 59,000,000 gallons over the November, 1921, figures. Stocks of kerosene on hand December 1 were 257,878,898 gallons, the figure being about 1,600,000 gallons above the stocks on November 1, but about 82,000,000 gallons less than on December 1, 1921.

Production of gas and fuel oils in November amounted to 891,590,171 gallons, a decrease of 30,000,000 gallons from the October production but an increase of 92,000,000 gallons over production for November, 1921. Stocks of these oils on December 1 amounted to 1,352,347,667 gallons, a decrease of 14,000,000 gallons during the month.

Production of lubricating oils in November was 89,270,847 gallons, a slight increase over the October production and an increase of 8,000,000 gallons over the production in November, 1921. Stocks of lubricating oils on hand December 1 amounted to 226,429,537 gallons, an increase of 9,000,000 gallons during the month.



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UNION PUMPS

Canada Has 12 Refineries With 55,000 Bbl. Capacity

Chatham, Ont., Canada.—Following is a list of refineries in Canada as of January 1, 1923, showing the location and capacity of the various plants:

Company and Location	Estimated Cap. in bbls.
Imperial Oil, Ltd., Sarnia, Ont.	12,000
Canadian Oil Cos., Ltd., Petrolia, Ont.	1,500
Cities Service Oil Co., Wallaceburg, Ont.	1,000
Canadian Prod. & Ref. Co., Petrolia, Ont.	
Imperial Oil, Ltd., Montreal, Que.	6,000
*Red Star Refineries, Ltd., Montreal Que.	10,000
Imperial Oil, Ltd., Halifax, N. S.	10,000
North Star Oil Co., Winnipeg, Man.	1,000
Imperial Oil, Ltd., Regina, Sask.	3,500
*Imperial Oil, Ltd., Calgary, Alta.	3,500
Southern Alberta Oils, Ltd., Calgary, Alta. (Plant in Okotoks field)	Small
Imperial Oil, Ltd., Ioco, B. C.	3,500
Union Oil Co. of Canada, Port Moody B. C.	1,000

*Under construction.

Gasoline Output of Pure Oil Shows Big Increase

Columbus, Ohio.—In 1922 the Pure Oil Company produced approximately 27,311,838 gallons of casinghead gasoline which was an increase of about 41 per cent over the 1921 production. The average daily production last year was approximately 74,826 gallons.

The Pure Oil Company has nine plants, the largest being located at Dawes, W. Va., with others in Ohio and Oklahoma.

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Consulting Chemist

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AND

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Forwood's Processes.
Distillation Under Pressure.
Cracking in Stills Under Pressure
Redwood and Dewar Process
Burton Process
Coast's Processes.
Cracking Heavy Oils in the Liquid State.
Tube and Retort Cracking in the Vapor Phase.
Hall's Processes and Methods.
Cracking in the Vapor State—Rittman Process.
The use of steam in Decomposing Heavy Oils to yield Naphtha and Gasoline.
Cracking in the Presence of Hydrogen, Hydro-carbon and Other Gases.
Chemical Methods of Cracking Oils.
Cracking and Distilling by Means of Fused Baths and Indirect Heating Means.
Cracking With the Aid of Internal Heat.
Cracking by Electrical Methods.
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New Absorption Plant for Desdemona-Gorman Section

Fort Worth, Texas.—The Hirt-MacDermott Gasoline Company has started construction work on a 2,000,000 cubic foot daily capacity absorption gasoline plant on the Mrs. M. E. Eppler farm, A. Smelzer Survey, in the east edge of the Desdemona-Gorman oil field in Eastland County, Texas. Only one unit will be constructed at present, but the owners contemplate adding more units as the gas supply in the field is made available. The project will represent an initial investment of about $75,000. L. E. Hirt and W. F. MacDermott are the principal owners of the company erecting the plant, and have offices at 1209 F. & M. Bank building, Fort Worth. According to tests made of the gas produced in the Desdemona-Gorman field, the gasoline yield amounts to four gallons per 1000 cubic feet.

Casper, Wyo.—The completion of the topping still by the E. T. Williams Oil Company in the Salt Creek field means that this company will have practically a complete refinery in the field. It will make possible for this company to run 150 barrels of crude daily in its work of getting naphtha to further continue process in the plant. The product of this plant may be sold to the Texas Company at Casper. The residue from the naphtha is used to run engines on the line of the Central Pipe Line Company from Salt Creek to Casper.

Tank Car Repairs

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Fleming Process to Be Installed by Lubrite

St. Louis, Mo.—Four Fleming cracking units are to be installed at the Lubrite Refining Company's plant at East St. Louis with the M. W. Kellogg Company in charge of the work. It is expected that the units will be in operation by the last of June or the first of July of this year.

The Lubrite Refining Company has entered on an extension program which will entail an expenditure when completed of about $500,000 and will place the plant in a position to adequately care for the increasing trade of the company in all departments.

It is understood, although not officially stated, that arrangements are pending whereby the Lubrite Company will be getting Oklahoma crude through its own connections.

Oklahoma City, Okla.—It is learned that negotiations are virtually completed for the operation of the Choate Oil Corporation refinery here by the Noble Oil and Gas Company. The Choate plant recently was sold under a court order, the purchaser being Judge W. R. Wallace of Pauls Valley, Oklahoma.

Utah Concern Has Plans For Increase in Capital

Salt Lake City, Utah.—A stock reorganization plan has been anonunced for the Utah Oil and Refining Company, which, when completed, will amount to the equivalent of a 1400 per cent dividend on 500,000 shares of common stock with a par value of $1 a share. The plan also provides for 5000 shares of 7½ per cent cumulative stock with a par value of $100.

The new arrangement will give the company a capitalization of $7,500,000 divided into 1,500,000 shares with a par value of $5.

Under the terms of the re-organization plan the Utah Oil and Refining will acquire about a one-twentieth interest in the Montana Producers Corporation, a Wyoming concern.

Midwest Will Increase the Capacity of Casper Plant

Casper, Wyo.—The Midwest Refining Company has started work on improving its gasoline plant here and orders have been placed for the necessary equipment. The Casper plant of the Midwest is recognized as the largest of its kind in the world.

Orders have been placed for three 1000 horse power 21½ by 36 tandem, double acting, four cycle gas engines to be furnished by the C. & G. Cooper Company of Mt. Vernon, Ohio. The engines will be direct connected with 15 by 32 inch gas compressors of the Bessemer type.

The contract for the engines calls for delivery in 90 days and work will begin immediately.

Vice President F. H. Thomas of the C. & G. Cooper Company and F. H. Thiel, chief engineer, have been on the ground for some time.

Midland Will Expend $500,000 on Refinery

El Dorado, Kans. — Improvements which will entail an approximate expenditure of $500,000 have been decided upon by officials of the Midland Refining Company here. When completed the improvements will make the Midland plant one of the most modern and best equipped refineries in Kansas and in the Mid-Continent field, according to W. G. Skelly of Tulsa, president of the Skelly Oil Company, of which Midland Refining is a subsidiary.

The Midland plant is to be enlarged and the present plant capacity of 5,000 barrels is to be doubled. Arrangements have been made for the installation of a battery of 1,000 barrel shell stills and the work is expected to be completed about April of this year. This will give the plant a daily capacity of around 10,000 barrels.

The Midland Company was organized in 1917 and the initial investment was approximately $1,500,000. The company has enjoyed a steady growth since that time until now the investments total in the neighborhood of $5,000,000 and the refining and marketing branches have been expanded to care for the steadily increasing trade.

Tonkawa Absorption Plant One of Oklahoma's Largest

Oklahoma City, Okla.—The Peppers Gasoline Company's absorption plant in the Tonkawa field is about completed. The plant is one of the largest in Oklahoma and will represent an investment of approximately $200,000 when finished.

The Peppers plant will have a capacity of 4,000,000 feet of gas a day and the finished product will be piped to Billings for loading in tank cars.

Casper, Wyo.—The refinery of the Standard Oil Company of Indiana here has begun work already this year in filling its 2,000,000 barrel order for foreign export gasoline for the year 1923. Thus far 12 trainloads, representing a total of 7,200,000 gallons, have been shipped from Casper over the Burlington to Baton Rouge, Louisiana, during the first 25 days of January. All of this gasoline is manufactured at the No. 3 plant of the Standard.

Tulsa, Okla.—M. W. Richardson, formerly with the Tulsa office of Gustafson & Spencer, Inc., has taken charge of a Tulsa office for the Spencer Petroleum Company, effective January 10. Mr. Richardson was formerly traffic manager for the Sapulpa Refining Company, later served for a time with Gustafson & Spencer, Inc., as traffic manager, and then went with the Carhill Petroleum Company as Tulsa manager. After a year he returned to the Gustafson & Spencer organization as a member of the Tulsa sales staff.

Denver, Colo.—Contracts for construction of a third unit at the company's natural gasoline plant in the Salt Creek field, Wyoming, have been awarded by the Midwest Refining Company.

To Build Absorption Plant In Shackelford County Pool

Fort Worth, Texas.—An absorption gasoline manufacturing plant representing an investment of approximately $250,000 is being erected by the Landreth Gasoline Corporation on the Wm. Poindexter tract, section 28 in the Ibex oil field, Shackelford County, Texas, and the project is to be completed by the first of June. The plant is to be equipped with 165 horsepower Bessemer engines and Ingersoll-Rand compressors. It will have three units and a daily capacity of 12,000,000 cubic feet of gas. W. L. Seeley, a well known construction engineer, is in charge of the erection of the plant.

The Landreth Gasoline Corporation will market its products from headquarters in the First National Bank Building, Breckenridge, Texas, and the following are officers of the concern: W. H. Landreth, president; W. M. Smith, vice president, and E. A. Landreth, secretary.

Transcontinental Starts Shipping From New Plant

Tulsa, Okla. — Operations at the Transcontinental Oil Company's refinery at Bristow, Oklahoma, which was recently completed, are reported as satisfactory with plenty of crude available for the stills. Shipments of refined products are being made from the plant, which is rated as a 5,000 barrel refinery.

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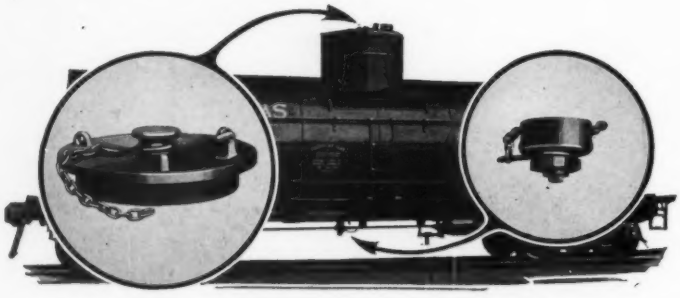
Survey of Natural Gasoline Industry Shows Bright Outlook in 1923—Stocks Very Low

Tulsa, Okla.—A comprehensive survey of the natural gasoline manufacturing field in the Mid-Continent, including Oklahoma, Kansas, North Texas and Louisiana, has just been completed by A. V. Bourque of Tulsa, secretary of the Association of Natural Gasoline Manufacturers, and discloses that the industry as a whole is entering the new year with stocks lower than in recent years. Some 150 manufacturers were queried in completing the survey and replies were received from about 133 throughout the field.

There is less than 500,000 gallons of natural gasoline available for immediate purchase, according to information obtained from the survey, and operators report a steady demand which has kept down the accumulated surplus that usually is on hand at this time of the year. It is estimated that less than 2,000,000 gallons is available to purchasers who are not protected by contracts but who come into the market at seasonable periods during the year and buy in quantity over a month or longer. This amount is not expected to be increased to any considerable extent within the next 30 to 60 days.

There now is a disposition on the part of natural gasoline manufacturers and refiners to contract for their requirements over the year at a price arrived at during the first part of the year which about equalizes the high quotation level of midsummer and the low point of winter. This practice is largely responsible for the depleted stocks in the Mid-Continent field.

According to Mr. Bourque, the daily natural gasoline output in the Southwest now is in the neighborhood of 1,250,000 gallons as compared to an output of slightly less than 1,000,000 gallons a day last year.



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Wichita, Kansas

Two New Gasoline Plants Of Empire Ready to Start

Bartlesville, Okla.—The gasoline plants of the Empire Gas and Fuel Company in Butler and Greenwood Counties, Kansas, are expected to be ready for operation by the first of March. Both plants are of the low pressure absorption type and both have been constructed so as to permit of expansion when desired. The capacity of each plant will be approximately 2,000,000 feet.

The Empire has recently completed its Fleeger eight-inch gas line in Elk County, Kansas, which is seven and a fourth miles in length. This gives the Empire 17 miles of eight-inch line, extending from the Cambridge compressor station into Elk County. The Fleeger line will connect up with approximately 30,000,000 cubic feet of gas in Elk County.

The Empire now has natural gasoline plants at Tallent, Covington, Okemah, Caney and at Arkansas City and expect to complete several more this spring.

Busy Season Is Forecast For Oklahoma Refineries

Ponca City, Okla.—A busy marketing season is forecast in improvements made or contemplated at refineries located here. The Empire Refineries have completed a battery of 1000 barrel coke stills at their Ponca City plant and the work of lining the 1400 barrel agitator has been finished. Work on the compounding plant is being speeded up and when completed will be one of the most modern and up-to-date in northern Oklahoma.

Although nothing official has been given out, it is known that the Marland refinery here will likely be enlarged during the year to care for the company's expanding trade not only in this section but throughout the country. The export outlet for Marland likely will necessitate an increased refinery output and E. W. Marland and other officials of the company now are in the Gulf Coast country inspecting terminal facilities in the vicinity of Galveston and Texas City.

Oklahoma City, Okla.—Garber Refining Company officials are reported to have secured an option on a site for a refinery at Perry, Oklahoma, which will be north of the proposed Glen Braden plant.

OUTPUT OF REFINERIES IN UNITED STATES FOR NOVEMBER, 1922

1922	East Coast (N.Y.,Phila. & Balt.)	Pa., N. Y., East Ohio & W. Va.	W. Ohio, Ind., Ill., Ky. & Tenn.	Oklahoma & Kansas	Texas
Crude Oil (bbl.)	8,753,576	1,871,393	4,075,828	6,827,000	8,520,364
Other Oils (bbl.)	855,398	112,859	370,078	528,156	857,667
Gasoline (gal.)	105,254,163	26,287,054	79,150,352	112,443,445	96,376,230
Kerosene (gal.)	61,982,072	13,672,891	18,373,673	29,550,770	62,090,840
Gasoline and Fuel (gal.)	163,867,331	17,782,986	58,838,305	127,242,547	180,133,089
Lubricating (gal.)	27,155,604	14,674,706	7,053,215	9,648,100	18,542,208
Wax (lb.)	17,016,867	7,077,877	3,903,532	2,863,009	3,010,952
Coke (ton)	15,400	1,716	18,164	1,893	8,436
Asphalt (ton)	72,131	151	10,061	.....	28,897
Miscellaneous (gal.)	7,136,483	4,396,156	9,381,525	17,848,374	11,500,986
Losses (bbl.)	373,405	117,983	145,331	267,005	393,193

1922	Louisiana and Arkansas	Colorado & Wyoming	California	TOTAL	DAILY AVERAGE 1922	DAILY AVERAGE 1921
Crude Oil (bbl.)	2,546,088	2,166,336	9,442,886	44,203,471	1,473,449	1,240,384
Other Oils (bbl.)	192,788	1,197,828	623,225	4,737,999	157,933	98,549
Gasoline (gal.)	32,092,110	50,911,339	64,586,228	567,100,921	18,903,364	14,396,228
Kerosene (gal.)	23,621,675	7,131,562	18,012,792	234,436,275	7,814,543	5,841,349
Gas and Fuel (gal.)	32,601,764	48,130,133	262,994,016	891,590,171	29,719,672	26,641,887
Lubricating (gal.)	4,352,179	1,370,501	6,474,334	89,270,847	2,975,695	2,566,835
Wax (lb.)	161,644	3,256,892	.....	37,290,773	1,243,026	1,385,808
Coke (ton)	7,104	6,137	.....	58,850	1,962	1,811
Asphalt (ton)	18,115	.....	27,367	156,722	5,224	3,461
Miscellaneous (gal.)	15,137,092	27,236,187	57,023,826	149,660,629	4,988,688	2,884,157
Losses (bbl.)	38,179	101,552	171,703	1,608,351	53,612	57,402

Booster Station Explosion Proves Fatal in West Texas

Fort Worth, Texas—An explosion in a booster station serving the Central Gasoline Producing Company's absorption plant located near Eliasville in Stephens County, Texas, early in January caused fatal injuries to one employe and serious burns and lacerations to 10 others, of which two are confined to a hospital with only bare chances for recovery. The building, which was covered with corrugated iron, was completely unroofed by the impact and the walls were practically blown clear of the steel framework of the building.

The cause of the explosion has not been fully determined. A crew of workmen were engaged in making some repairs to a gas pipe line within the building when the accident occurred, and it is believed that a spark was developed from the tools in use about the time that gas started escaping from one of the pipes or fittings. Outside of a few brass connections being burned off and minor damages to the engines and compressors in the building, the property loss was confined to the roof and walls of the structure. This has since been repaired, and the plant is again in operation.

Bureau of Mines Completes Study of Oklahoma Plants

Washington, D. C.—The Bureau of Mines has completed an investigation of the practical operation of gasoline plants of the Mid-Continent field, in which gasoline containing objectionable sulphur compounds is treated for removal of the sulphur. When the need for such treatment first became obvious about 1920, in order to permit such gasoline to meet rigid export requirements, the Bureau of Mines first developed a suitable method and was largely instrumental in having it installed by the gasoline operators. The report on the present investigation, which deals with the costs and efficiencies of the treatment as applied in the different plants, will soon be available. D. B. Dow, chemical engineer, who made the investigation, obtained construction data, accurate operating costs, and photographs of gasoline treating plants at Shidler, Oklahoma, and Kansas City, which are claimed to be the largest plants of their type in the world.

Improvements to Be Made On Stephens County Plant

Fort Worth, Texas.—About $100,000 is being expended by the Highpower Gasoline Corporation on its absorption gasoline manufacturing plant located on the Jesse R. Smith farm in Stephens County, Texas, about 2½ miles south of Breckenridge to increase its daily capacity and to extend its gathering lines in the field. Five new 80 h. p. Bessemer engines are being installed, and the steam driven pumping equipment in the plant is being changed over to the belt drive. The Highpower Corporation maintains headquarters at 1514 Magnolia Bldg., Dallas.

T. & P. Oklahoma Refinery Now Under Construction

Oklahoma City, Okla.—Construction work already has started on the new refinery to be erected by the Texas Pacific Coal and Oil Company at Wynnewood, Oklahoma. It is understood that the first section of the refinery will have a rated capacity of about 2,000 barrels and will be in operation by the first part of June.

A pipe line is being strung from the Robberson field and a pump station is now being built. The Texas Pacific Coal and Oil is one of the largest producers in the Robberson territory.

Derby Oil Will Increase Output by Improvements

Wichita, Kans.—An increase in output of approximately 33 per cent will result from extensions and improvements now being made at the Wichita refinery of the Derby Oil Company. The improvement program includes the installation of two steam stills and two high pressure stills and altogether will involve an expenditure of around $300,000.

The Universal Oil Products Company of Chicago is installing a part of the equipment at the Derby plant, which is rated as a 5,000 barrel refinery modern type and design.

STOCKS ON HAND AT THE REFINERIES NOVEMBER 30, 1922

1922	East Coast (N.Y.,Phila. & Balt.)	Pa., N. Y., East Ohio & W. Va.	W. Ohio, Ind., Ill., Ky. & Tenn.	Oklahoma & Kansas	Texas
Crude Oil (bbl.)	9,767,740	1,196,139	863,072	2,405,952	7,491,259
Other Oils (bbl.)	191,154	35,134	226,691	17,835	.....
Gasoline (gal.)	146,706,083	17,359,336	92,359,728	146,485,035	105,135,477
Kerosene (gal.)	85,365,015	12,660,847	31,563,281	30,464,113	54,281,162
Gas and Fuel (gal.)	302,239,507	26,457,732	33,327,587	115,017,132	322,003,104
Lubricating (gal.)	95,488,646	35,896,073	17,956,877	13,814,436	44,100,487
Wax (lb.)	51,879,566	28,031,576	21,819,791	5,313,774	11,118,413
Coke (ton)	14,094	316	5,194	2,934	5,665
Asphalt (ton)	59,476	2,898	8,812	201	11,406
Miscellaneous (gal.)	117,106,566	40,368155	67,672,062	65,891,068	211,797,991

1922	Louisiana and Arkansas	Colorado & Wyoming	California	Total stocks end of Nov. 1922	Total stocks end of Nov. 1921
Crude Oil (bbl.)	4,464,017	3,121,115	3,456,068	32,765,362	21,856,185
Other Oils (bbl.)	.....	164,058	530,423	1,165,295	873,324
Gasoline (gal.)	92,761,273	92,653,282	83,263,405	776,723,619	495,590,059
Kerosene (gal.)	15,244,353	5,546,424	22,753,703	257,878,898	340,026,007
Gas and Fuel (gal.)	217,185,385	30,011,666	306,105,554	1,352,347,667	1,279,450,548
Lubricating (gal.)	2,619,461	3,081,131	13,472,426	226,429,537	228,037,890
Wax (lb.)	80,641,210	2,853,766	426,134	202,084,230	216,515,861
Coke (ton)	.....	3,547	.....	31,750	59,076
Asphalt (ton)	14,405	249	12,582	110,029	120,275
Miscellaneous (gal.)	98,477,201	58,656,731	158,831,321	878,801,095	679,654,792

XUM

÷ REFINERY SUPPLIES ÷

Chemical Market Remains Firm With Some Increase in Demand—Few Price Changes

Chicago, Ill., Feb. 5.—Animal, Fish and Vegetable oils have in a majority of instances advanced somewhat in price, the past month, while chemicals used by refiners, though generally strengthening in position, have registered few price changes.

Among chemicals interest rather centers around Benzol, supplies of which have gradually been materializing the past month. Demand has been strong and consistent, and sellers have not cared to entertain carlot business. Pure in drums is selling at 35 to 40 cents per gallon, and 90 per cent at 32 to 37 cents, representing, if anything, a gain in price.

Potash Permanganate has advanced approximately half a cent during the month as a result of active demand and a slightly advancing cost of replacement. Potash Bichromate is quoted a quarter cent higher than 30 days ago. Other chemicals are unchanged in price.

Fish Oils Scarce

Among animal, fish and vegetable oils, fish oils registered the most notable advance. Herring Oil being 5 cents higher, and Menhaden 3 cents higher, while other fish oils are firm. Scarcity of supplies is the explanation, supplies of Menhaden, in particular, being practically exhausted.

Neatsfoot Oil advanced approximately 2 cents early in the month as a result of high prices of crude materials, and have maintained that position. Horse Oil, Red Oil, Soya Bean Fatty Acids, Castor Oil and Lard Oils are others which have advanced a half cent to 2 cents during the month, while many others have shown advances of small fractions of a cent.

Naval Stores Stronger

Turpentine advanced approximately 5 cents early in January, in sympathy with a strong advance in the British market, accompanied by the report that there was very little French and Spanish turpentine available. Movement into consuming channels has been regarded as well above normal, due to active construction work and painting operations which it is believed will continue. Demand slackened later in the month, and price today is around 150½, or 3½ cents higher than a month ago.

Rosins show a wider price range than formerly, water white being quoted approximately 25 cents higher, but the lower grades being quoted lower than a month ago.

OIL JOBBERS SUPPLIES

Prices based on original packages in large quantities f. o. b. manufacturing point—unless otherwise specified.

Animal, Fish and Vegetable Oils

Lard Oils	Price Feb. 1
Prime, bbls., lb	.15
Extra Winter Strained, bbls., lb	.14
Extra, bbls., lb	13½
Extra No. 1, bbls., lb	13¼
No. 1, bbls., lb	.13
No. 2, bbls., lb	12½
Tallow, prime edible, lb.	.09½
Tallow Oil, acidless, bbls., lb.	12¾
Lard Stearine bbls., lb.	12¾
Oleo Stearine, bbls., lb.	.10 10½
Neatsfoot Oil—	
Pure 20 cold test, bbls., bl.	18½
Pure 30, cold test, bbls., lb.	16½
Extra, bbls., lb	13¼
No. 1, bbls., lb	.13
Horse Oil, bbls., lb	8½
Red Oil, distilled, bbls., lb.	11½
English Degras, bbls., lb.	4½ .05
Domestic Degras, bbls., lb.	4¾ .05
Menhaden Fish Oil—	
Light Pressed bbls., gal.	.67 .69
Yelow bleached, bbls., gal.	.70 .72
Herring Oil, tanks, coast, gal.	.42 .50
Whale Oil, bleached, bbls., gal.	.75
Sperm Oil, bleached, bbls., gal.	.99 1.04
Soya Bean Oil, pressed, bbls., lb.	12½ 12¾
Soya Bean Fatty Acids, tanks, West, lb.	13¼ 13½
Tallow Fatty Acids, bbls., lb.	.07 .07½
Castor Oil—	
No. 1, bbls., lb	.13
No. 3, bbls., lb	12½
Corn Oil—	
Middle West, tanks, lb.	.9½ 10
Cooperage, l. c. l.	11¼
Linseed Oil—	
Carloads, bbls., gal.	.86 .90
Leses than 5 bbls., gal.	.95

NAVAL STORES

(Quotations by National Rosin Oil & Size Company, Chicago.)

Rosins—		
B to I, bbls., (280 lbs.)	$6.15	$6.20
10-20 bbl. lots, f. o. b. shipping point	7.20	...
K to WW bbls. (280 lbs.)	6.25	8.25
10-20 bbl. lots, f. o. b. shipping point	7.35	9.35
Turpentine, spirits ex yard gal.		1.50½
In drums		1.53
Rosin Oil, first run, gal.		.45
Rosin Oil, second run, gal.		.47
Rosin Pitch, bbl.		6.00
Tar, kiln burned		12.50
Tar, retort		12.00

REFINERS' SUPPLIES

Prices are based on original packages, in large quantities, and represent spot quotations, unless otherwise stated, f. o. b. manufacturing points.

(Quotations by Wishnick-Trumpeer Chem. Co., Chicago.)

Soda Ash, light bags, cwt.	1.75	2.10
Silicate of Soda, 60 deg., tanks cwt.		1.75
Sal Soda, cwt.	1.10	1.30
Caustic Soda, 76% drums, cwt.	3.60	3.75
Chlorate of Soda, kegs, lb.		.07
Nitrate of Soda, cwt.		2.60
Potash Permanganate, lb.	16½	17½
Potash Bichromate, sacks, lb.	.10	10¼
Sulphuric Acid, 66 deg., tank cars ton	.14	.16
Acetic Acid—		
28%, bbls., lb.	.03¼	.04
56%, bbls., lb.	.06¼	.07
80%, bbls., lb.	.09¾	.10¼
Fullers Earth, 16-30 mesh, carloads, ton	$23.00	25.00
Chloride of Lime, cwt.	2.00	2.25
Benzol, pure, water white, gal.	.35	.40
Benzol, 90%, gal.	.32	.37
Toluol, gal.	.30	

OIL REFINERY EQUIPMENT

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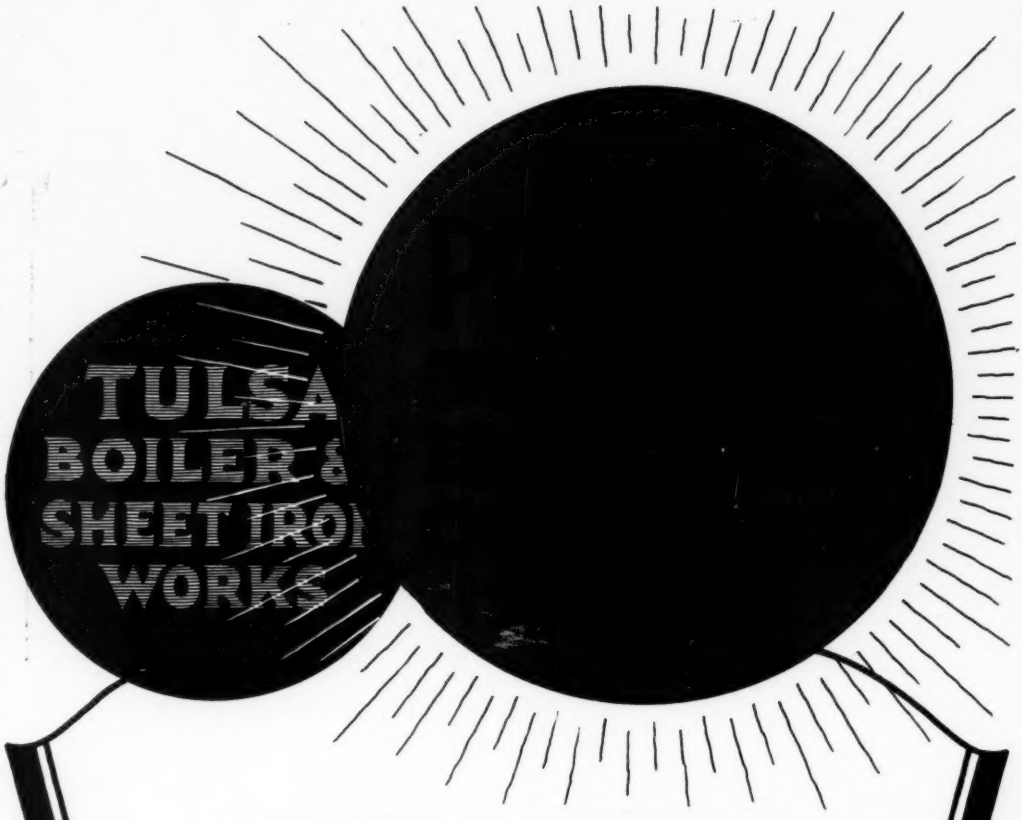

A New Name for an Old Friend

What's in a name, anyway? The refinery construction work we are doing under the name "Pioneer" is just the same high grade as when it bore the name "Tulsa Boiler and Sheet Iron."

For eighteen years, as the "Tulsa Boiler and Sheet Iron Works", we have turned out tanks and refinery steel construction that made good friends for us among the wise buyers of the Mid-Continent. We pioneered in giving these people "close to home" service on the best kind of work.

Now, under our new name, "The Pioneer Tank and Boiler Company," we're all set with the men, machinery and money to keep on growing under the Pioneer banner like we did when Tulsa Boiler and Sheet Iron was on our letterhead.

There is no change in our organization.

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Pioneer Tank & Boiler Co.

(Formerly Tulsa Boiler & Sheet Iron Works)

BOX 1926

TULSA, OKLAHOMA

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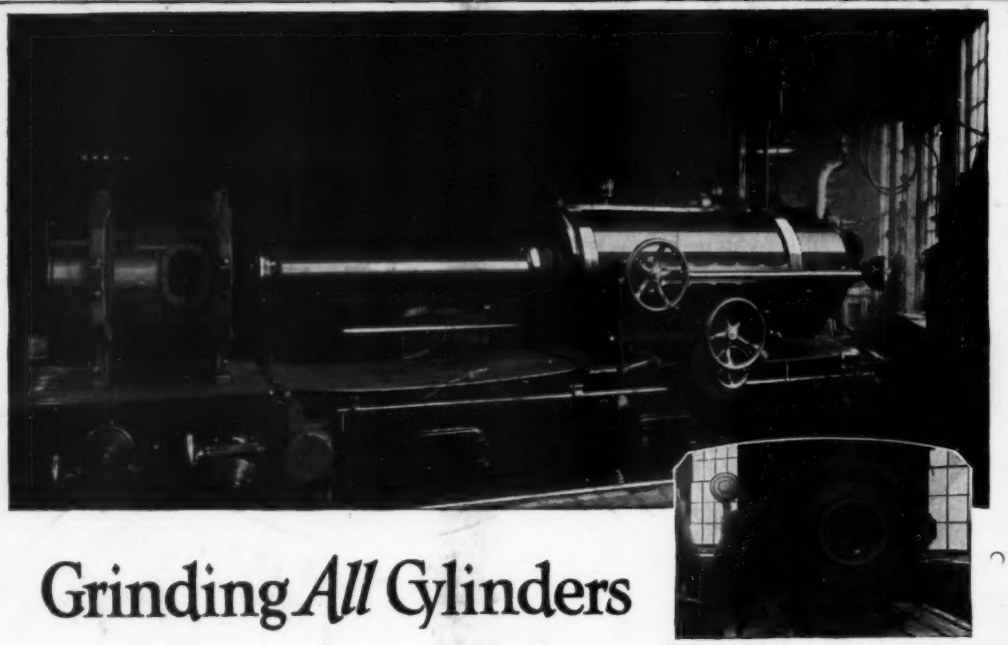

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